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January 31st, 2008

Mr. Ross del Rosario
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

RE: Sauget Area 1 – Mass Flux Estimates

Dear Ross:

Attached, please find the requested copy of the "Mass Flux Estimates for Sauget Area 1" report dated November 15th, 2005.

We are also sending Sandra Bron two additional copies.

Any questions, please advise.

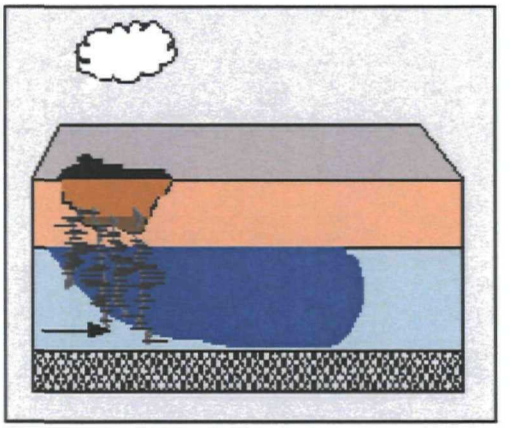
Sincerely

Steven D. Smith

cc: Sandra Bron – IEPA - 2 hard copies

SAUGET AREA 1, SAUGET AND CAHOKIA, ILLINOIS

MASS FLUX ESTIMATES



November 15, 2005

Groundwater Services, Inc.
2211 Norfolk, Suite 1000, Houston, Texas 77098

1.0 EXECUTIVE SUMMARY

Calculations were performed to estimate mass flux of chlorobenzene, 1,4-dichlorobenzene, and benzene due to: i) groundwater flushing in the alluvial aquifer beneath Site I; ii) leaching of unsaturated Site I source zone materials prior to installation of a low permeability cover; and iii) leaching of unsaturated Site I source zone materials after installation of a low permeability cover. Three different Site I source areas were considered in the leaching calculations (6.43 acres, 9.47 acres, and 19 acres). Key findings are as follows:

- Prior to installation of a low permeability cover, estimated mass flux from leaching of unsaturated source materials is relatively small compared to estimated mass flux in groundwater (1% to 15.6% - see table below). After installation of a low permeability cover, estimated mass flux from leaching of unsaturated source materials is very small compared to estimated mass flux in groundwater (0.001% to 0.018%).

- Leachate recovery would remove only a relatively small mass of these COCs at the Site I source zone and therefore would not significantly reduce the time to meet groundwater remedial goals in groundwater beneath and downgradient of Site I. The results of this evaluation apply to all other COCs and to Sites G, H, and L.

Calculation results for the 19-acre source area (i.e., worst case) are shown below and on Figures 4 and 5.

Scenario	COC	Mass Flux at Site I (kg/yr)		Ratio (B/A)
		A - Mass Flux Due to Lateral Groundwater Flow (MHU + DHU)	B - Leaching from Unsaturated Source Materials(19 acres)	
Existing Conditions	CB	1741	17	1.0%
Low-K Cover	CB	1741	0.02	0.001%
Existing Conditions	1,4-DCB	1026	16	1.5%
Low-K Cover	1,4-DCB	1026	0.02	0.002%
Existing Conditions	Benzene	13	2.0	15.6%
Low-K Cover	Benzene	13	0.002	0.018%

2.0 INTRODUCTION

Leachate recovery at Sites G, H, I, and L is a component in remedial alternative arrays presented in the Sauget Area 1 Engineering Evaluation/Cost Analysis and Remedial Investigation/Feasibility Study (EE/CA and RI/FS). However, USEPA has acknowledged that leachate recovery is largely an issue related to satisfying State ARARs and may not reduce the time to meet remedial goals.

As requested by the PRPs, Groundwater Services, Inc. (GSI), performed mass flux calculations to estimate mass flux of chlorobenzene, 1,4-dichlorobenzene, and benzene due to: i) groundwater flushing in the alluvial aquifer beneath Site I; ii) leaching of unsaturated Site I source zone materials prior to installation of a low permeability cover; and iii) leaching of unsaturated Site I source zone materials after installation of a low permeability cover.

Site I has the largest surface area of the four sites and generally has the highest concentrations of COCs. Therefore, the findings of this evaluation for Site I are considered applicable to Sites G, H, and L.

Mass flux calculations presented herein evaluated two VOCs (chlorobenzene and benzene) and one SVOC (1,4-dichlorobenzene) that are: i) found in the Sauget Area 1 waste materials; ii) prevalent in groundwater underlying Sauget Area 1, and iii) considered relatively mobile in groundwater. As documented in this memorandum, the findings from these calculations show that leachate recovery would remove only a relatively small mass of these COCs at the Site I source zone and therefore would not significantly reduce the time to meet groundwater remedial goals.

Since these findings apply to major COCs that are relatively mobile in groundwater, they should also apply to other COCs that are present at Sauget Area 1.

KEY POINT: APPLICABILITY OF THIS EVALUATION

This memo presents mass flux calculations for three COCs at Site I, but the findings from this evaluation apply to all other COCs and to Sites G, H, and L.

3.0 PROJECT BACKGROUND

3.1 Description of Site I

Site I was originally a sand and gravel pit that received industrial and municipal wastes from 1931 to 1957. Site I is approximately 19 acres in area and underlies a large, fenced, controlled-access, gravel covered truck parking lot and the Sauget City Hall and associated parking lots. Soil samples collected from Site I have indicated elevated levels of VOCs (e.g., benzene, chlorobenzene), SVOCs, pesticides, herbicides, PCBs, and metals.

It has been reported by the PRPs that the northern portion of Site I was used primarily for disposal of wastes such as broken concrete, bricks, and other construction debris. Test

trenches and borings confirm the presence of construction wastes and fill soils at the northern portion of Site I. Based on waste characterization data (see Attachment 3) and analytical data from the DNAPL study (GSI, 2005), VOC and SVOC concentrations are significantly lower in waste samples collected from the northern portion of Site I compared to waste samples collected from the southern portion of Site I. A 1964 aerial photograph (see Attachment 1) shows the probable boundary between the northern and southern disposal areas at Site I.

The source area is an important variable in the calculation of mass flux of COCs due to leaching of unsaturated source materials. Section 6.0 of this memorandum presents mass flux calculations for leaching using the following three alternate assumptions for source area:

- Case 1: Area of residual DNAPL (6.43 acres)
- Case 2: Southern area of Site I interpreted from 1964 air photo (9.47 acres)
- Case 3: Entire area of Site I (19 acres).

3.2 Hydrogeology

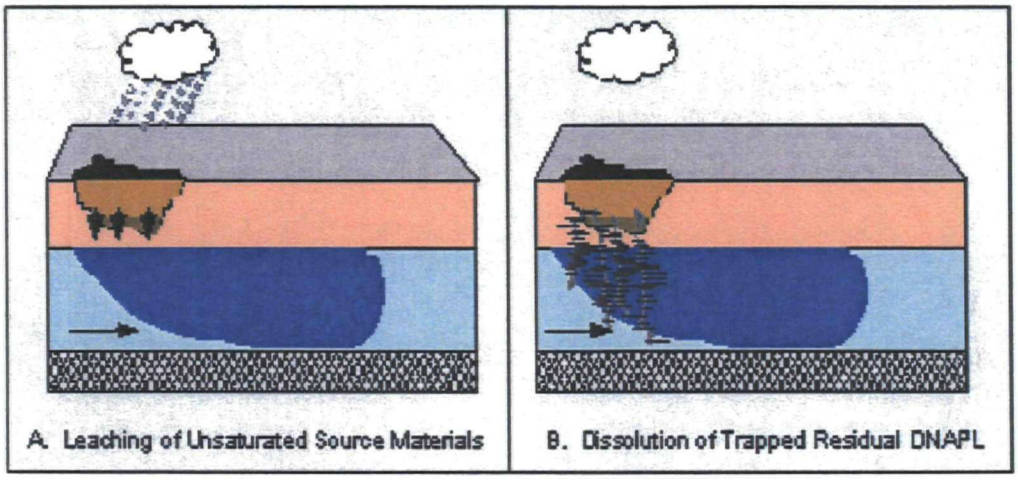
Sauget Area 1 is located in the Mississippi River floodplain in an area referred to as the American Bottoms. The geology of the area is described as consisting of unconsolidated valley fill deposits (Cahokia Alluvium) overlying glacial outwash material (Henry Formation). In general, the permeability of the unconsolidated material increases with depth, with the outwash material being comprised of medium to coarse-grained sand and gravel. The hydrogeologic conceptual model divides the unconsolidated water-bearing unit into three horizons: the Shallow Hydrogeologic Unit, or SHU (generally 15-30 ft deep), the Middle Hydrogeologic Unit, or MHU (generally 30-70 ft deep), and the Deep Hydrogeologic Unit, or DHU (generally 70-110 ft deep). These unconsolidated deposits are underlain by limestone and dolomite bedrock.

3.3 Study Constituents

Chlorobenzene and 1,4-dichlorobenzene were initially selected for the mass flux evaluation based on the presence of elevated concentrations of these COCs in groundwater to the west (i.e., downgradient) of Site I and elevated concentrations in Toxicity Characteristic Leaching Procedure (TCLP) samples collected from unsaturated source materials. Benzene was later added to the mass flux evaluation based on USEPA comments to a draft version of this memorandum. Benzene was the only other COC detected in groundwater downgradient of Site I that was also detected in the TCLP samples collected from the source materials. The concentrations of benzene detected in groundwater downgradient of Site I were one to two orders of magnitude lower than the concentrations of chlorobenzene and 1,4-dichlorobenzene.

4.0 SOURCE RELEASE MECHANISMS

Knowledge of which source mechanisms are active at a site is important for developing an accurate conceptual model of constituent fate and transport, and for developing appropriate remedial responses. Two source mechanisms that have the potential to be active at Sauget Area 1 are leaching of unsaturated source materials and residual DNAPL dissolution in the alluvial aquifer resulting in mass flux of COCs through lateral groundwater flow.



Two Potential Groundwater Source Mechanisms

Leaching of unsaturated source materials (see Panel A above) results from infiltration of rainfall through near-surface waste materials and contaminated unsaturated soils. Residual DNAPL dissolution (see Panel B above) occurs when soluble organic constituents dissolve from trapped residual DNAPL fingers and pools that entered the subsurface when the source area was active.

Mass flux of COCs in groundwater flowing beneath the unsaturated source materials can be calculated from COC concentration data for the groundwater downgradient of the source materials and groundwater flow rates determined using Darcy's Law and aquifer parameters. These calculations are described in more detail in Section 5.0 of this memorandum.

Mass flux of COCs due to leaching of unsaturated source materials can be calculated using TCLP data from waste samples collected in the source materials, predicted rates of leachate generation determined by the Hydrologic Evaluation of Landfill Performance (HELP) model, and the estimated surface area of the source materials. These calculations are described in more detail in Section 6.0 of this memorandum.

5.0 MASS DISCHARGE RATE DUE TO LATERAL GROUNDWATER FLOW

5.1 Approach for Calculating Groundwater Flow Rate Using Darcy's Law

Darcy's Law: Darcy's Law, which describes the rate of movement of water through a porous medium, can be expressed in general terms as:

Flowrate = (Hydraulic conductivity) x (Hydraulic gradient) x (Cross sectional area of flow)

Hydraulic conductivity (K) is an aquifer parameter that is determined from pumping tests or slug tests. For a specific site, the value of K can be taken from pumping tests or slug test at that site, or from test results reported in a regional study of the aquifer. Hydraulic conductivity is expressed in units of length per time.

Hydraulic gradient (i), which has units of length/length, represents the change in hydraulic head between two points along the direction of groundwater flow, and is determined from potentiometric surface maps for the water-bearing unit.

The cross sectional area of flow is determined by multiplying i) the thickness of the water-bearing unit, as determined from borings, and ii) the width of a specified flow area, as measured perpendicular to the groundwater flow direction. (For these mass flux calculations, the area of interest is the DNAPL source zone within the water-bearing unit, so the width term is referred to as the source width.)

Calculation of Mass Flux due to Lateral Groundwater Flow: The mass flux of COCs due to lateral groundwater flow is calculated by multiplying the estimated groundwater flowrate through the DNAPL source zone by the COC concentrations in groundwater immediately downgradient of the DNAPL source zone. Mass flux has units of mass per time.

5.2 Aquifer Parameters

Aquifer Thickness: As discussed in Section 3.0, the hydrogeologic conceptual model divides the unconsolidated water-bearing unit into three hydrogeologic units (shallow, middle, and deep). The SHU is generally 0-30 ft below grade, the MHU is generally 30-70 ft below grade, and the DHU is generally 70-110 ft below grade. Depth to water is typically about 15 ft, which means that only the lower 15 ft of the SHU is saturated. Therefore, the assumed saturated thicknesses for the SHU, MHU, and DHU are 15 ft, 40 ft, and 40 ft, respectively.

Hydraulic Conductivity: Separate hydraulic conductivity estimates were developed for the SHU, MHU, and DHU. Estimates of hydraulic conductivity are available from: 1) literature reports, and 2) preliminary analysis of RI/FS slug test data. The literature reference (Ritchey and Schicht, 1982) reported that the following: hydraulic conductivity for the unconsolidated material used for water supply in the American Bottoms area:

Range of Hydraulic Conductivities from Ritchey and Schicht, 1982
$5x10^{-2}$ to $1.4x10^{-1}$ cm/sec

The analysis of RI/FS slug test data from wells near Site I showed the following hydraulic conductivities (see Table 4-14 in the EE/CA and RI/FS report, Roux Associates, June 2001):

Hydrogeologic Unit	Site I Well	Hydraulic Conductivity (cm/sec)
Shallow	ST-I-S	$4.5x10^{-3}$
Middle	ST-I-M	$5.1x10^{-2}$
Deep	ST-I-D	$1.3x10^{-1}$

As requested by USEPA, the site-specific hydraulic conductivity values calculated from the Site I slug tests were used in the mass flux calculations.

Hydraulic Gradient: Hydraulic gradients in the SHU, MHU, and DHU were estimated based on review of potentiometric surface maps (see Figures 4-28 through 4-39 in the EE/CA and RI/FS report, Roux Associates, June 2001). Based on review of these maps, the following hydraulic gradients were selected for use in the mass flux calculations:

- Shallow Hydrogeologic Unit: 0.001 ft/ft
- Middle Hydrogeologic Unit: 0.001 ft/ft
- Deep Hydrogeologic Unit: 0.001 ft/ft

5.3 Source Widths and Groundwater Flux

Source Widths: Source widths at Site I for the SHU, MHU, and DHU were based on DNAPL areas at Site I identified by the DNAPL Characterization and Remediation Study (GSI, 2005). The Site I source widths are 800 ft for the SHU (see Figure 1), 700 ft for the MHU, and 700 ft for the DHU (see Figure 2).

Groundwater Flow Rates: Groundwater flow rates through the SHU, MHU, and DHU source zones were obtained using Darcy's Law and the values for hydraulic conductivity, hydraulic gradient, aquifer thickness, and source width as discussed above. The calculated groundwater flux values were as follows:

- Shallow Hydrogeologic Unit: 0.8 gpm
- Middle Hydrogeologic Unit: 21.0 gpm
- Deep Hydrogeologic Unit: 53.6 gpm

5.4 Groundwater Concentration Data Downgradient of Site I

Average chlorobenzene, 1,4-dichlorobenzene, and benzene concentrations in the SHU, MHU, and DHU immediately downgradient of Site I were determined based on average concentrations in groundwater samples from the 0-30 ft, 30-70 ft, and 70-110 ft intervals, respectively, at groundwater sampling location AA-I-S1. At this location, groundwater

samples were collected at various depths within the alluvial aquifer (see figures and table in Attachment 2).

Hydrogeologic Unit	Avg. Chlorobenzene Concentration at AA-I-S1 (mg/L)	Avg. 1,4-DCB Concentration at AA-I-S1 (mg/L)	Avg. Benzene Concentration at AA-I-S1 (mg/L)
SHU	5.2	2.2	0.46
MHU	12.3	7.7	0.081
DHU	11.5	6.6	0.088

5.5 Mass Flux Due to Lateral Groundwater Flow

To estimate mass flux due to lateral groundwater flow beneath Site I, average concentration in groundwater immediately downgradient of Site I was multiplied by groundwater flow rate through the source zone. The mass flux calculations assumed uniform source concentrations in the SHU, the MHU, and the DHU throughout the Site I source zone.

Mass Flux Due to Lateral Groundwater Flow			
Hydrogeologic Unit	Chlorobenzene (kg/yr)	1,4-DCB (kg/yr)	Benzene (kg/yr)
SHU	8.2	3.5	0.7
MHU	515	322	3.4
DHU	1226	704	9.4

Chlorobenzene and 1,4-dichlorobenzene have significantly higher estimated mass flux rates in groundwater than benzene, especially in the Middle Hydrogeologic Unit (MHU) and Deep Hydrogeologic Unit (DHU).

KEY POINT: MASS FLUX DUE TO LATERAL GROUNDWATER FLOW

Mass flux values for chlorobenzene from the SHU, MHU, and DHU of the Site I source zone are estimated to be 8.2 kg/yr, 515 kg/yr, and 1226 kg/yr, respectively (Figure 4). Mass flux values for 1,4-dichlorobenzene from the SHU, MHU, and DHU of the Site I source zone are estimated to be 3.5 kg/yr, 322 kg/yr, and 704 kg/yr, respectively (Figure 4). Mass flux values for benzene are estimated to be significantly lower.

6.0 ESTIMATED RATE OF MASS FLUX BY LEACHING AT SITE I

6.1 Approach for Calculating Mass Flux from Leaching of Source Materials

The equation used for calculating mass flux of each COC due to leaching of unsaturated source materials can be expressed as follows:

Mass Flux = (Leachate concentration) x (Percolation rate) x (Surface area of source materials)

Leachate concentration (in units of mg/L) for each COC was based on laboratory results of TCLP analyses of waste samples collected in 1999 from the Site I source materials. Results of these analyses are discussed in Section 6.2.

Estimated percolation rates, or leachate generation rates (in units of inches/year), were determined using the Hydrologic Evaluation of Landfill Performance (HELP) model. The HELP model was used to predict the percolation rates at Site I under two scenarios: i) existing conditions; and ii) after installation of a low permeability cover. Section 6.3 summarizes HELP model input parameters and calculated results.

The surface area in the above equation refers to the surface footprint of the waste materials at Site I. Section 6.3 discusses the three alternate values for this area that were used in the mass flux calculations (6.43 acres, 9.47 acres, and 19 acres).

6.2 Results of TCLP Analysis of Waste Samples from Site I

Waste sampling and testing were conducted at the Sauget Area 1 fill areas in 1999. Using conventional hollow-stem auger drilling equipment, continuous soil samples were collected from the ground surface to approximately two feet below the bottom of the fill material in four borings each at Sites G, H, I, L, and N (see Figure 4.11 in Attachment 3).

The sample interval from each boring with the highest PID reading was submitted for analysis of VOCs. Samples to be analyzed for other constituents, including SVOCs, were composited over the entire boring profile. Constituent concentrations were determined in a laboratory using the TCLP method. Analytical results (Attachment 3) were presented in the EE/CA and RI/FS Support Sampling Plan Data Report, January 2001. For the four waste sample borings at Site I, TCLP results for chlorobenzene, 1,4-dichlorobenzene, and benzene were as follows:

Waste Sample ID	TCLP Test Result for Chlorobenzene (mg/L)	TCLP Test Result for Benzene (mg/L)
Waste-I-B1 (14-16 ft)	0.35	0.068
Waste-I-B2 (2-4 ft)	8.9	0.14
Waste-I-B4 (0-2 ft)	<0.02	<0.02
Waste-I-B5 (24-26 ft)	1.4	0.76
Waste-I-B5 (24-26 ft) - Duplicate	1.0	0.26
Median Value	1.2	0.14

Waste Sample ID	TCLP Test Result for 1,4-Dichlorobenzene (mg/L)
Waste-I-B1-Comp	0.0056 J
Waste-I-B2-Comp	1.3
Waste-I-B4-Comp	<0.05
Waste-I-B5-Comp	1.5
Waste-I-B5-Comp (Duplicate)	0.63
Median Value	1.1

In determining median values, the sample and duplicate sample results for boring Waste-I-B5 were averaged and non-detect results for boring Waste-I-B4 were excluded. Waste-I-B4 was drilled in the northern portion of Site I (see Figure 4-11 in Attachment 3).

6.3 Surface Area of Source Materials

As discussed in Section 3.0, the total area of Site I is approximately 19 acres, but it has been reported by the PRPs that the northern portion of Site I was used primarily for disposal of construction wastes. It is possible that the mass flux of COCs leached from the fill/waste lmaterials northern portion of Site I is small compared to the mass flux of COCs from the southern portion of Site I. Therefore, the mass flux calculations were performed using three alternate values for source area.

- Case 1: Area of residual DNAPL from Figure 1 in DNAPL Report (6.43 acres)
- Case 2: Southern area of Site I interpreted from 1964 air photo (9.47 acres)
- Case 3: Entire area of Site I (19 acres).

6.4 Calculation of Leachate Generation Rates

The Hydrologic Evaluation of Landfill Performance (HELP) model (Version 3.07, November 1997) was used to predict the rate of leachate generation at Site I under two scenarios: i) existing conditions; and ii) after installation of the low permeability cover detailed on Figure 9-6 in the Sauget Area 1 EE/CA and RI/FS report, Revision 1 (see Attachment 4).

The model run for existing conditions used the following key input parameters:

Average Precipitation*	34.70 inches/year
Runoff Curve Number	85
Evaporative zone depth	12 inches
Hydraulic Conductivity:	
Soil layer 1 (4 inches thick)	1×10^{-2} cm/sec
Soil layer 2 (164 inches thick)	1×10^{-3} cm/sec

* Default historical value generated by HELP model for St.Louis, MO.

The model run for the low permeability cover used the following key input parameters:

Average Precipitation*	34.70 inches/year
Runoff Curve Number	96
Evaporative zone depth	0.2 inches
Hydraulic Conductivity:	
(see Attachment 4 for proposed cover layer details)	

Key input parameters for low permeability cover (continued)

Layer 1 (Asphalt)	6.8×10^{-7} cm/sec
Layer 2 (Asphalt)	6.8×10^{-7} cm/sec
Layer 3 (IDOT Stone)	0.3 cm/sec
Layer 4 (Soil cover)	5.2×10^{-4} cm/sec
Layer 5 (Drainage layer)	10 cm/sec
Layer 6 (HDPE liner)	2×10^{-13} cm/sec
Layer 7 (Bentonite)	3×10^{-9} cm/sec
Layer 8 (Bedding layer)	5.2×10^{-4} cm/sec
Layer 9 (Landfill soil)	1×10^{-3} cm/sec

* Default historical value generated by HELP model for St.Louis, MO.

Output from the HELP model (see Attachment 4) indicates that average annual percolation through the unsaturated waste and fill materials at Site I is approximately 7.3 inches/year under existing conditions. After the low permeability cover is installed, average annual leakage through the bottom layer of the low permeability cover is estimated at approximately 8×10^{-2} inches/year.

6.5 Mass Flux by Leaching of Unsaturated Source Materials at Site I

Mass flux leaching of unsaturated source materials was calculated using median TCLP leachate concentrations, calculated percolation/leakage rates, and the three alternate values for the Site I source area (6.43 acres, 9.47 acres, and 19 acres).

Mass Flux of Chlorobenzene (kg/yr)			
Scenario	**Case 1: 6.43 acre Source Area**	**Case 2: 9.47 acre Source Area**	**Case 3: 19 acre Source Area**
Existing Conditions	5.8	9	17
Low-K Cover	0.007	0.01	0.02

Mass Flux of 1,4-Dichlorobenzene (kg/yr)			
Scenario	**Case 1: 6.43 acre Source Area**	**Case 2: 9.47 acre Source Area**	**Case 3: 19 acre Source Area**
Existing Conditions	5.3	8	16
Low-K Cover	0.006	0.01	0.02

Mass Flux of Benzene (kg/yr)			
Scenario	**Case 1: 6.43 acre Source Area**	**Case 2: 9.47 acre Source Area**	**Case 3: 19 acre Source Area**
Existing Conditions	0.7	1.0	2.0
Low-K Cover	0.001	0.001	0.002

KEY POINT: MASS FLUX FROM LEACHING OF UNSATURATED FILL/WASTE

Without a low permeability cover, estimated mass flux values for chlorobenzene, 1,4-dichlorobenzene, and benzene due to leaching of unsaturated source materials at the Site I source zone are 17 kg/yr, 16 kg/yr, and 2 kg/yr, respectively (Figure 4), assuming a source area of 19 acres.

After installation of a low permeability cover, mass flux values for chlorobenzene, 1,4-dichlorobenzene, and benzene due to leaching decrease significantly, and are estimated to be 0.02 kg/yr, 0.02 kg/yr, and 0.002 kg/yr, respectively (Figure 5), again assuming a 19 acre source area.

7.0 COMPARISON OF MASS FLUX ESTIMATES

As summarized on Figures 4 and 5, estimated mass flux of chlorobenzene, 1,4-dichlorobenzene, and benzene from leaching of unsaturated Site I source materials is small compared to estimated mass flux of these three COCs by lateral groundwater flow in the alluvial aquifer underlying Site I. Mass flux ratios were calculated by dividing the mass flux due to leaching from unsaturated source materials by the mass flux due to lateral groundwater flow through the MHU and DHU.

The findings, shown on Figures 4 and 5, indicate that interior leachate recovery would remove only a relatively small mass of chlorobenzene, 1,4-dichlorobenzene, and benzene at Site I and therefore would not significantly reduce the time to meet remedial goals.

KEY POINT: EFFECTIVENESS OF LEACHATE RECOVERY

Interior leachate recovery would remove only a relatively small mass of the COCs and therefore would not significantly reduce the time to meet remedial goals.

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GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

TABLES AND FIGURES

GROUNDWATER SERVICES, INC.

Table 1
Mass Flux Calculations for Three COCs at Site I
Sauget Area 1, Sauget and Cahokia, Illinois

Estimated Mass Flux Due to Lateral Groundwater Flow

	Shallow Hydrogeologic Unit	Middle Hydrogeologic Unit	Deep Hydrogeologic Unit	MHU+DHU
Saturated thickness (ft)	15	40	40	-
K from slug tests (cm/sec)	0.0045	0.051	0.13	-
K from slug tests (ft/day)	13	145	369	-
Hydraulic Gradient (ft/ft)	0.001	0.001	0.001	-
Site I Source Width (ft)	800	700	700	-
Groundwater Flux (gal/day)	1,145	30,278	77,179	-
Groundwater Flux (gal/min)	0.8	21.0	53.6	-
Avg. Chlorobenzene Conc. At AA-I-S1 (mg/L)	5.2	12.3	11.5	-
Avg. 1,4-DCB Conc. At AA-I-S1 (mg/L)	2.2	7.7	6.6	-
Avg. Benzene Conc. At AA-I-S1 (mg/L)	0.46	0.081	0.088	-
Mass Flux - Chlorobenzene (kg/yr)	8.2	515	1,226	1,741
Mass Flux - 1,4-DCB (kg/yr)	3.5	322	704	1,026
Mass Flux - Benzene (kg/yr)	0.7	3.4	9.4	13

GROUNDWATER SERVICES, INC.

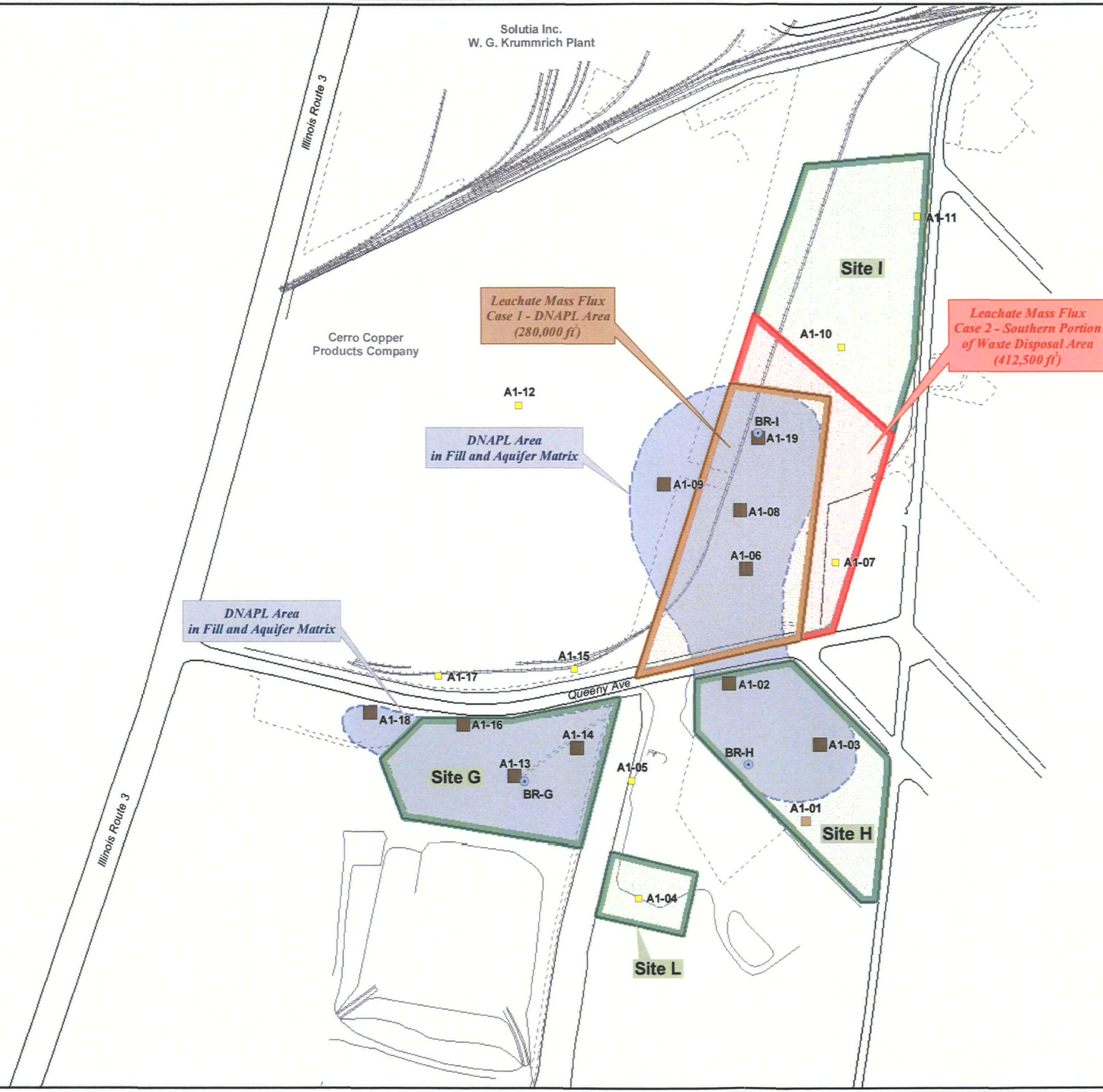
Table 1
Mass Flux Calculations for Three COCs at Site I
Sauget Area 1, Sauget and Cahokia, Illinois

Estimated Leachate Mass Flux from Unsaturated Source Materials

	Source Area = 6.43 acres		Source Area = 9.47 acres		Source Area = 19 acres	
	(no cover)	(with cover)	(no cover)	(with cover)	(no cover)	(with cover)
Chlorobenzene Concentration, TCLP (mg/L)	1.2	1.2	1.2	1.2	1.2	1.2
1,4-DCB Concentration, TCLP (mg/L)	1.1	1.1	1.1	1.1	1.1	1.1
Benzene Concentration, TCLP (mg/L)	0.14	0.14	0.14	0.14	0.14	0.14
Area of Site I Source Zone in Fill/Waste (acres)	6.43	6.43	9.47	9.47	19	19
Area of Site I Source Zone in Fill/Waste (sq. ft.)	280,000	280,000	412,500	412,500	827,640	827,640
Percolation/Leakage Rate from HELP model (in/yr)	7.3	0.0084	7.3	0.0084	7.3	0.0084
Mass Flux - Chlorobenzene (kg/yr)	5.8	0.007	9	0.01	17	0.02
Mass Flux - 1,4-DCB (kg/yr)	5.3	0.006	8	0.01	16	0.02
Mass Flux - Benzene (kg/yr)	0.7	0.001	1.0	0.001	2.0	0.002

Mass Flux Ratios - (Leachate Mass Flux) / (Mass Flux through MHU and DHU)

	Source Area = 6.43 acres		Source Area = 9.47 acres		Source Area = 19 acres	
	(no cover)	(with cover)	(no cover)	(with cover)	(no cover)	(with cover)
Chlorobenzene	0.3%	0.0004%	0.5%	0.0006%	1.0%	0.001%
1,4-Dichlorobenzene	0.5%	0.0006%	0.8%	0.0009%	1.5%	0.002%
Benzene	5.3%	0.0061%	7.8%	0.0089%	15.6%	0.018%



LEGEND

- Existing bedrock wells
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs > 1 mg/kg and/or total SVOCs > 1 mg/kg.
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs < 1 mg/kg and total SVOCs < 1 mg/kg.
- No field evidence of NAPL based on visual inspection of cores or vial test kit results.

Notes:

1) The vial test kits contained Sudan IV dye, which is soluble in DNAPL and petroleum and stains DNAPL and petroleum products red. Each test kits also contained a small bead of polystyrene, which will develop a pink halo or hue in the presence of TPH at concentrations exceeding approximately 500 mg/kg.

2) Vial test results for a soil sample were considered as evidence for the presence of NAPL if: i) a layer of LNAPL or DNAPL was observed in the vial; ii) red spots or staining were noted in the vial; or iii) the polystyrene ball in the vial was observed to have a pink halo or hue.

3) Results of soil core inspection and testing for borings A1-1 through A1-18 are documented on Table 3.

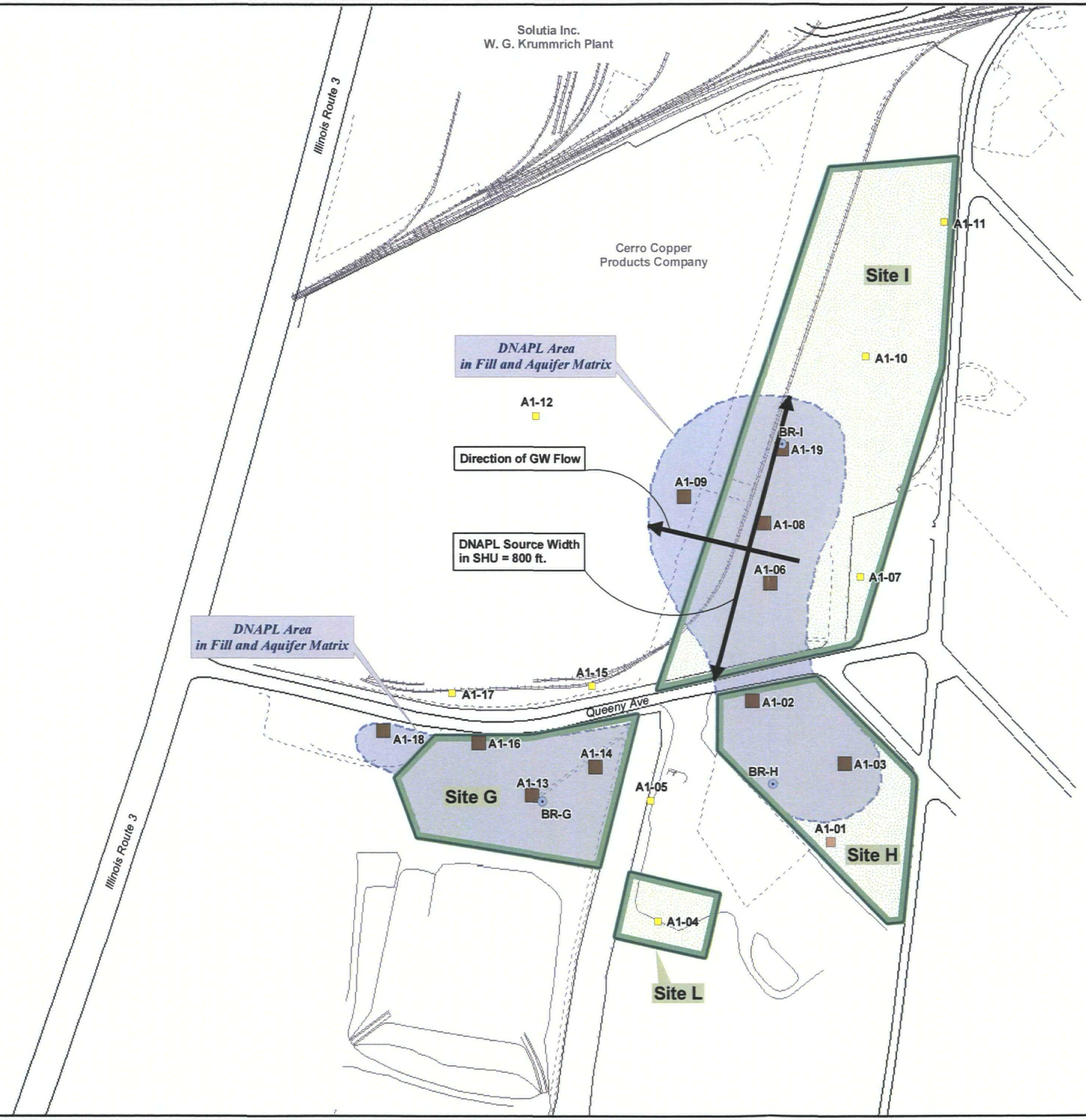
Scale (ft)
0 150 300

GROUNDWATER SERVICES, INC.

CASE 1 AND CASE 2 - AREA OF UNSATURATED SOURCE MATERIALS

DNAPL Characterization and Remediation Study
Sauget Area 1
Sauget and Cahokia, Illinois

GSI Job No.	G -2876	Drawn By:	TUH/CDM
Issued:	11/15/05	Chk'd By:	JAK
Revised:		Aprv'd:	
Scale:	As Shown		**Figure 1**



N

LEGEND

- Existing bedrock wells
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs > 1 mg/kg and/or total SVOCs > 1 mg/kg.
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs < 1 mg/kg and total SVOCs < 1 mg/kg.
- No field evidence of NAPL based on visual inspection of cores or vial test kit results.

Notes:

1) The vial test kits contained Sudan IV dye, which is soluble in DNAPL and petroleum and stains DNAPL and petroleum products red. Each test kits also contained a small bead of polystyrene, which will develop a pink halo or hue in the presence of TPH at concentrations exceeding approximately 500 mg/kg.

2) Vial test results for a soil sample were considered as evidence for the presence of NAPL if: i) a layer of LNAPL or DNAPL was observed in the vial; ii) red spots or staining were noted in the vial; or iii) the polystyrene ball in the vial was observed to have a pink halo or hue.

3) Results of soil core inspection and testing for borings A1-1 through A1-18 are documented on Table 3.

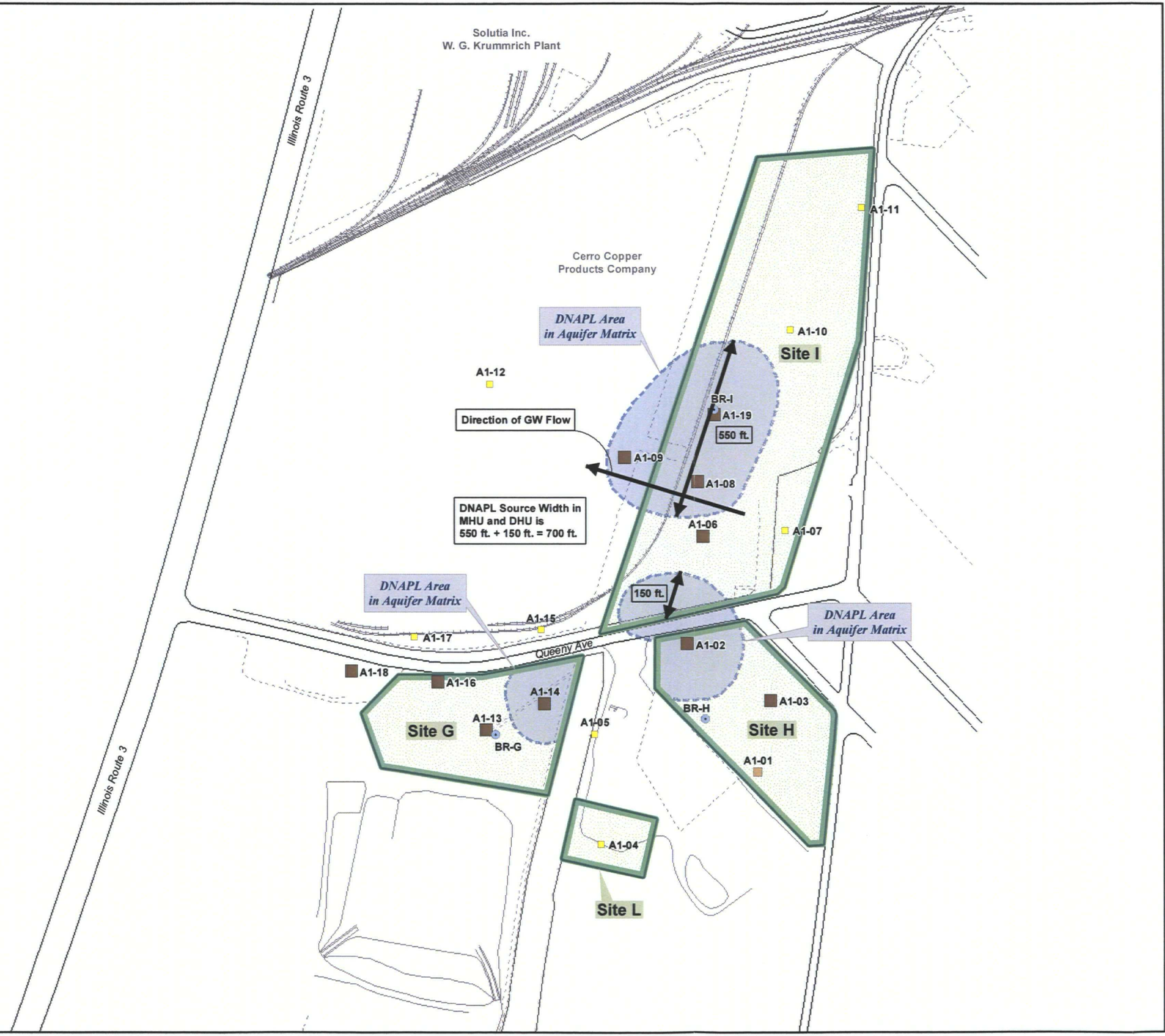
Scale (ft)
0 150 300

GROUNDWATER SERVICES, INC.

SOURCE WIDTH IN SHALLOW HYDROGEOLOGIC UNIT

DNAPL Characterization and Remediation Study
Sauget Area 1
Sauget and Cahokia, Illinois

GSI Job No.	G -2876	Drawn By:	TUH/CDM
Issued:	11/15/05	Chk'd By:	JAK
Revised:		Aprv'd:	
Scale:	As Shown		**Figure 2**



N

LEGEND

- Existing bedrock wells
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs > 1 mg/kg and/or total SVOCs > 1 mg/kg.
- Field evidence of NAPL based on visual inspection of cores and/or vial test kit results. Total VOCs < 1 mg/kg and total SVOCs < 1 mg/kg.
- No field evidence of NAPL based on visual inspection of cores or vial test kit results.

Notes:

1) The vial test kits contained Sudan IV dye, which is soluble in DNAPL and petroleum and stains DNAPL and petroleum products red. Each test kits also contained a small bead of polystyrene, which will develop a pink halo or hue in the presence of TPH at concentrations exceeding approximately 500 mg/kg.

2) Vial test results for a soil sample were considered as evidence for the presence of NAPL if: i) a layer of LNAPL or DNAPL was observed in the vial; ii) red spots or staining were noted in the vial; or iii) the polystyrene ball in the vial was observed to have a pink halo or hue.

3) Results of soil core inspection and testing for borings A1-1 through A1-18 are documented on Table 3.

Scale (ft)
0 150 300

GROUNDWATER SERVICES, INC.

SOURCE WIDTH IN MIDDLE AND DEEP HYDROGEOLOGIC UNITS

DNAPL Characterization and Remediation Study
Sauget Area 1
Sauget and Cahokia, Illinois

GSI Job No.	G -2876	Drawn By:	TUH/CDM
Issued:	11/15/05	Chk'd By:	JAK
Revised:		Aprv'd:	
Scale:	As Shown		**Figure 3**

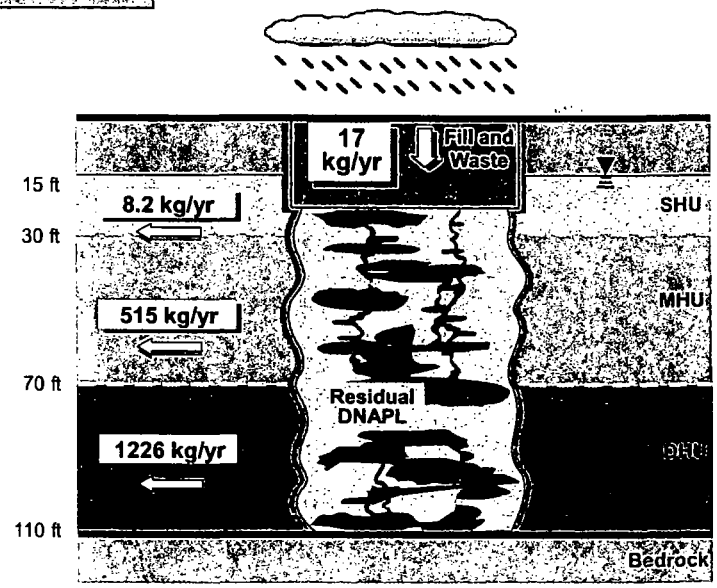
GSI Job No. G-2876
Issued: 11/15/05
Page 1 of 2

FIGURE 4
MASS FLUX AT SITE I SOURCE ZONE (19 Acres)
WITHOUT COVER

Sauget Area 1, Sauget, Illinois

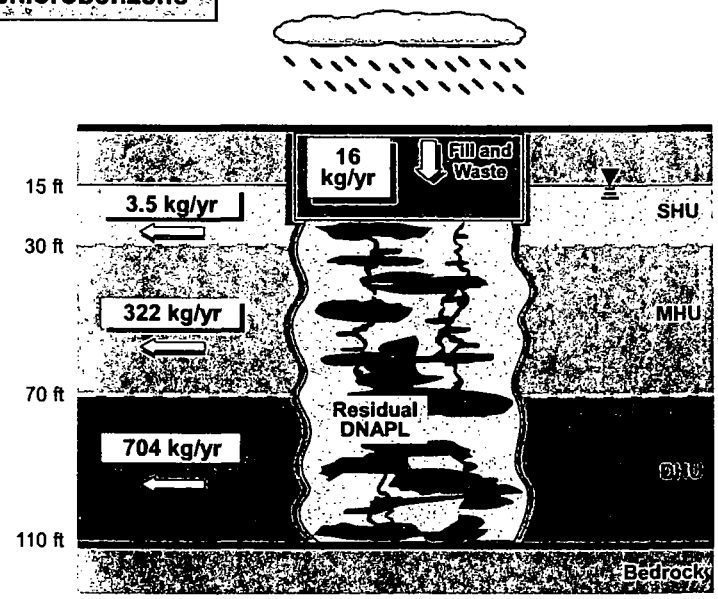
GROUNDWATER SERVICES, INC.

Chlorobenzene



$$\text{CB Flux Ratio} = \frac{17 \text{ kg/yr}}{(515 + 1226) \text{ kg/yr}} = 1.0\ \%$$

1,4-Dichlorobenzene



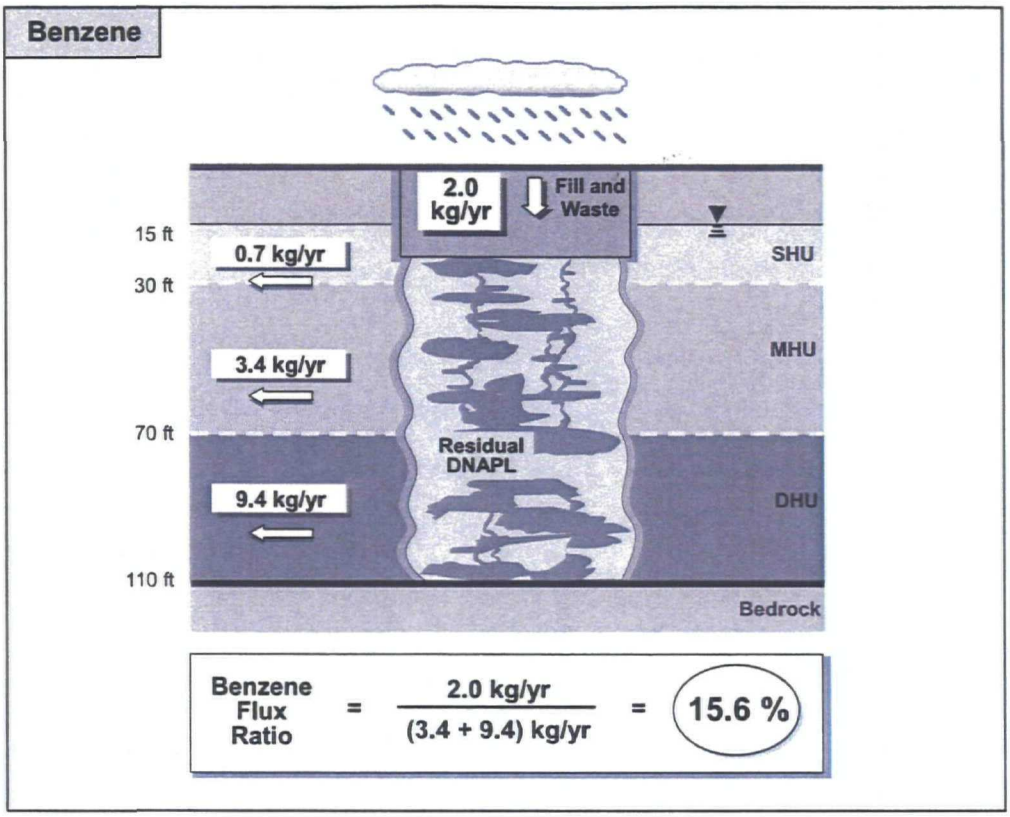
$$\text{1,4-DCB Flux Ratio} = \frac{16 \text{ kg/yr}}{(322 + 704) \text{ kg/yr}} = 1.5\ \%$$

GSI Job No. G-2876
Issued: 11/15/05
Page 2 of 2

FIGURE 4
MASS FLUX AT SITE I SOURCE ZONE (19 Acres)
WITHOUT COVER

Sauget Area 1, Sauget, Illinois

GROUNDWATER SERVICES, INC.



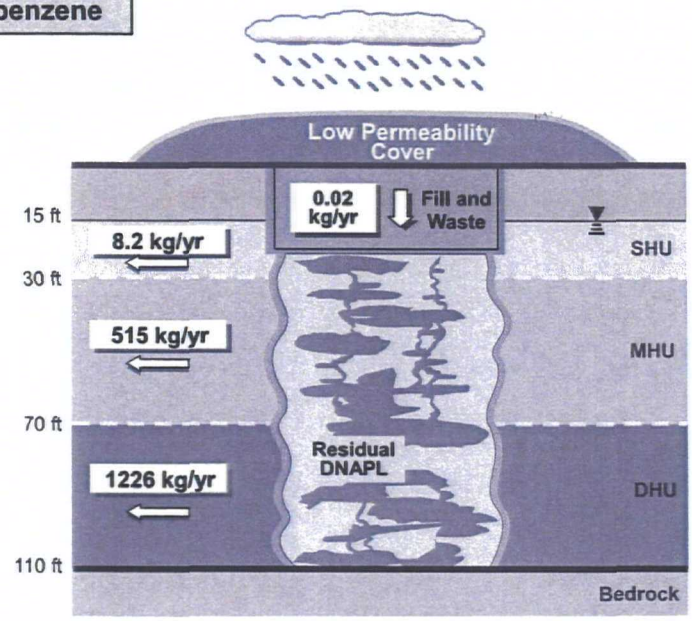
GSI Job No. G-2876
Issued: 11/15/05
Page 1 of 2

FIGURE 5
MASS FLUX AT SITE I SOURCE ZONE (19 Acres)
WITH COVER

Sauget Area 1, Sauget, Illinois

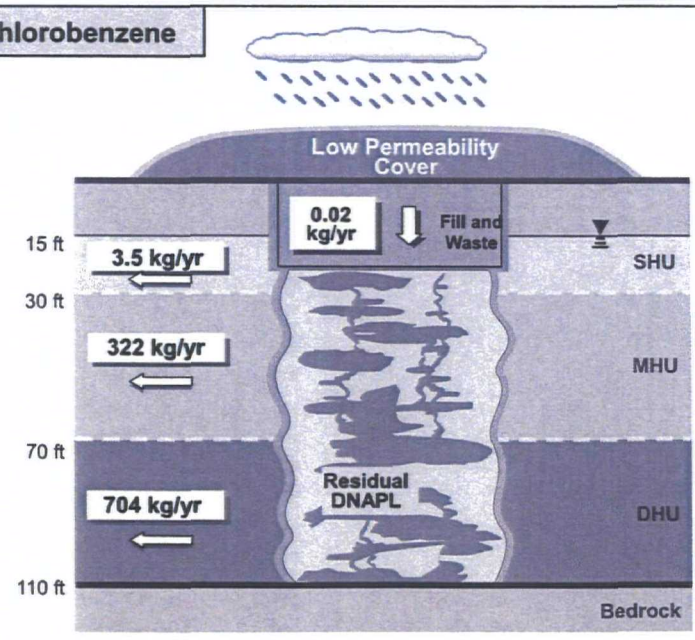
GROUNDWATER SERVICES, INC.

Chlorobenzene



$$\text{CB Flux Ratio} = \frac{0.02 \text{ kg/yr}}{(515 + 1226) \text{ kg/yr}} = 0.001\ \%$$

1,4-Dichlorobenzene



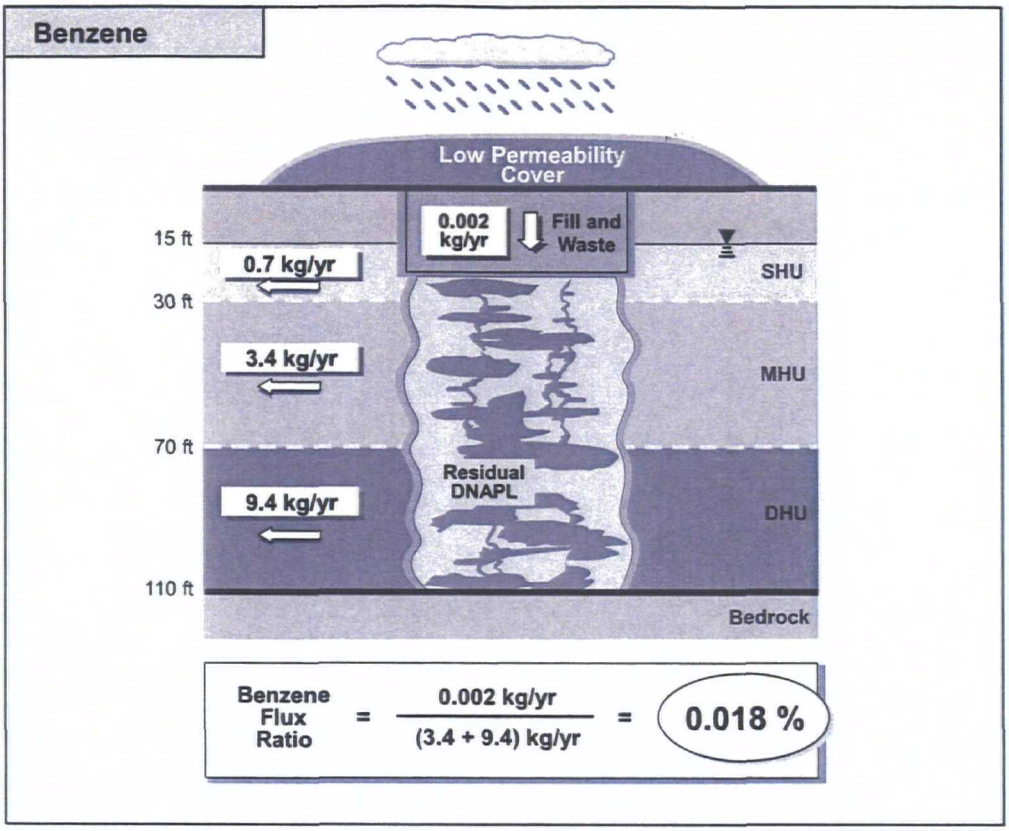
$$\text{1,4-DCB Flux Ratio} = \frac{0.02 \text{ kg/yr}}{(322 + 704) \text{ kg/yr}} = 0.002\ \%$$

GSI Job No. G-2876
Issued: 11/15/05
Page 2 of 2

FIGURE 5
MASS FLUX AT SITE I SOURCE ZONE (19 Acres) *WITH COVER*

Sauget Area 1, Sauget, Illinois

GROUNDWATER SERVICES, INC.



GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENTS

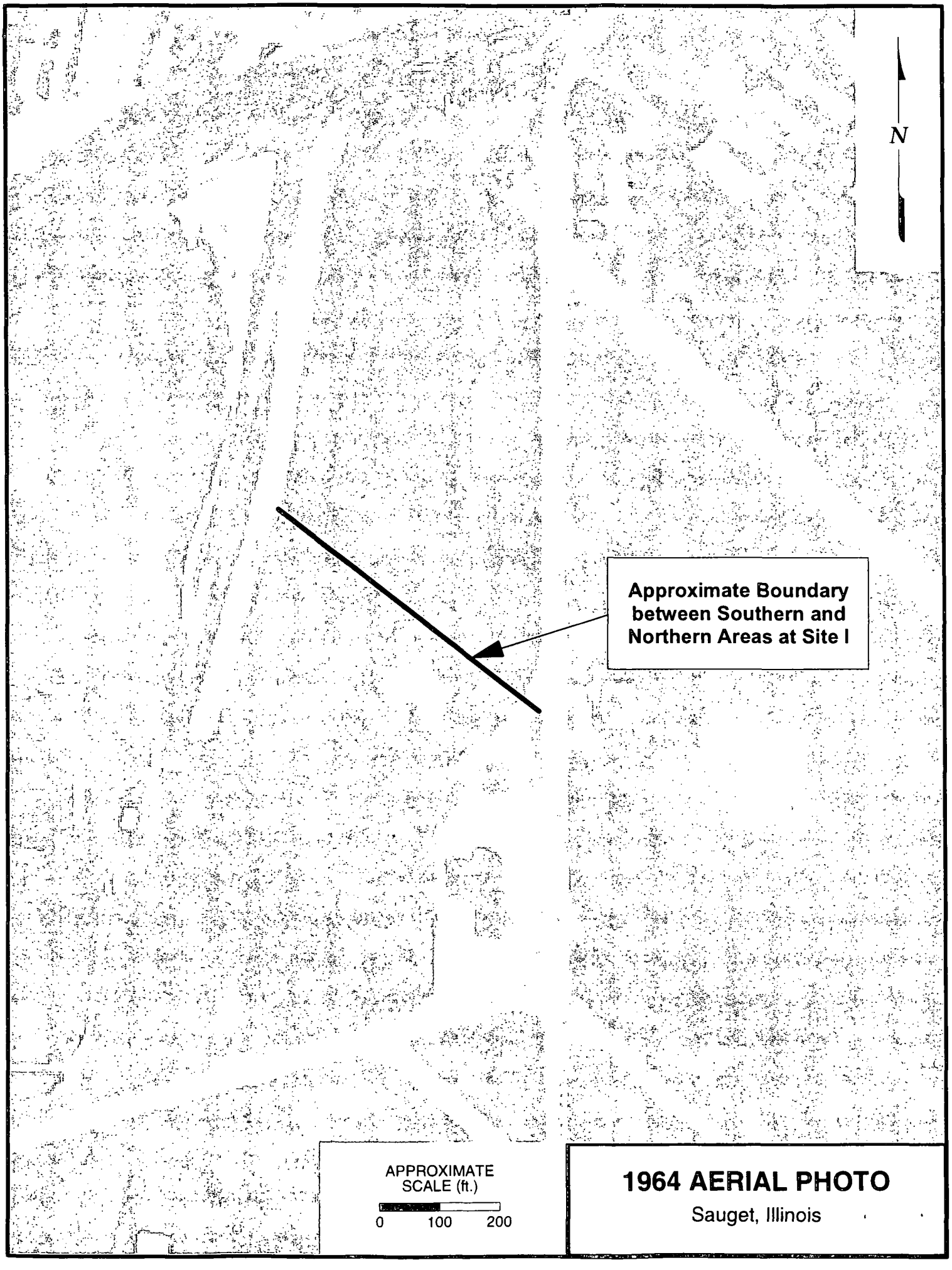
GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENT 1 – 1964 AIR PHOTO OF SAUGET AREA 1


N
Approximate Boundary between Southern and Northern Areas at Site I
APPROXIMATE SCALE (ft.)
0
100
200
1964 AERIAL PHOTO
Sauget, Illinois

GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENT 2 – SELECTED HISTORICAL GROUNDWATER ANALYTICAL DATA

Figure B-1: Chlorobenzene Concentrations in Groundwater

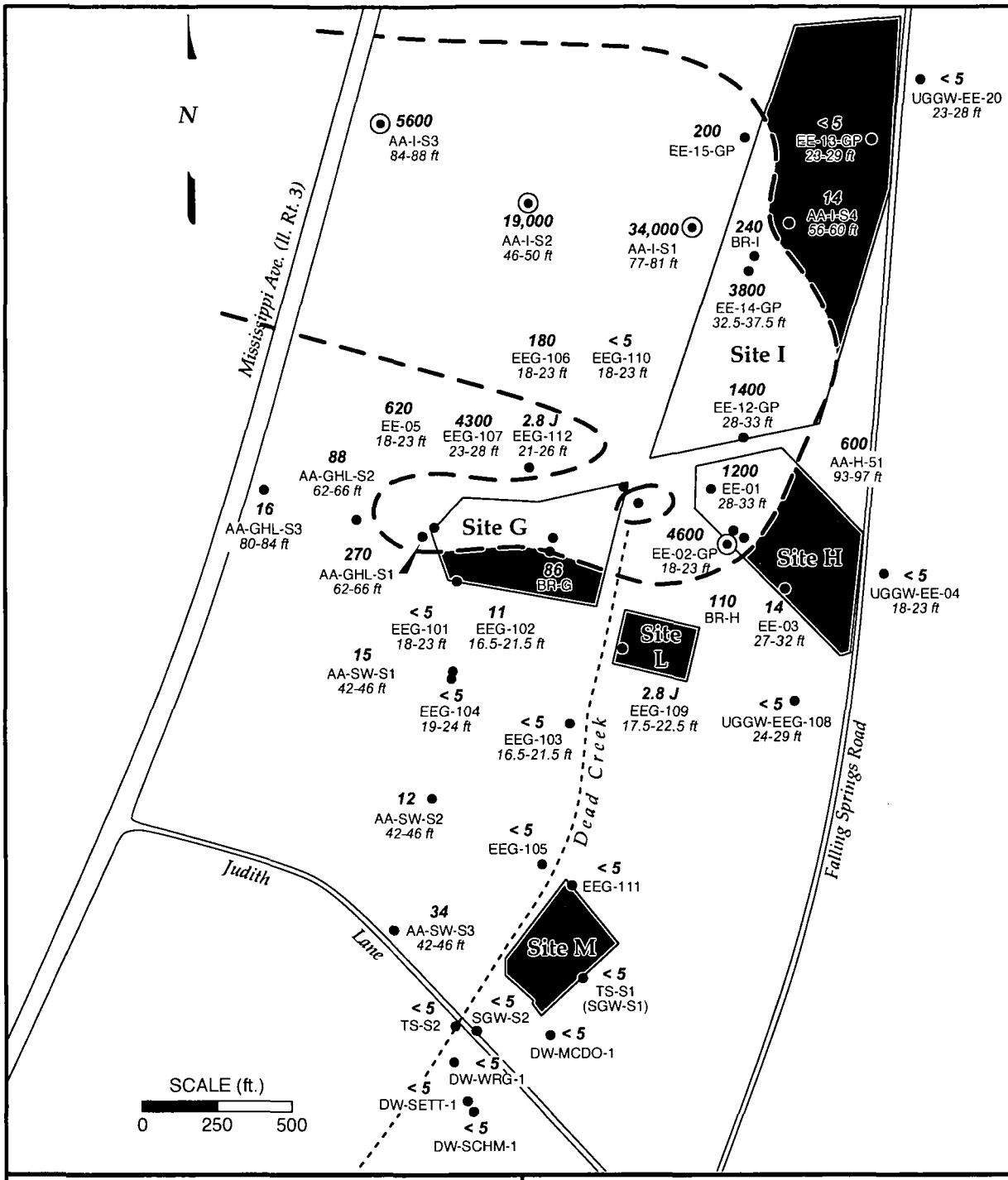
Figure B-2: Chlorobenzene Concentrations vs. Depth in Groundwater

Figure B-3: 1,4-Dichlorobenzene Concentrations in Groundwater

Figure B-4: 1,4-Dichlorobenzene Concentrations vs. Depth in Groundwater

Table 2-1: Benzene Concentrations in Groundwater at AA-I-S1

Note: Figures B-1 through B-4 were included in Results of DNAPL Characterization and Remediation Study, Groundwater Services, Inc., January 21, 2005. These figures were adapted from Figures 5-1 through 5-4 of the Sauget Area 1 EE/CA and RI/FS report, Revision 1, Roux Associates, June 8, 2001.



NOTES: 1) Illinois Class I Standard for chlorobenzene: 100 µg/L.

2) Chlorobenzene selected for contouring as it had highest concentration of VOCs at AA-I-S3.

3) Pure phase solubility of chlorobenzene in water is approximately 445,000 µg/L, so 1% of solubility is 4,450 µg/L.

LEGEND

600	Maximum concentration over entire depth interval
●	Sampling locations (µg/L) from 1999-2000 Sampling Program
AA-GHL-S3	Well name
80-84 ft	Depth interval with maximum concentration (ft bgs.)
○	Exceeds 1% of solubility is (>4,450 µg/L).
— —	Concentration exceeding Class I Standard

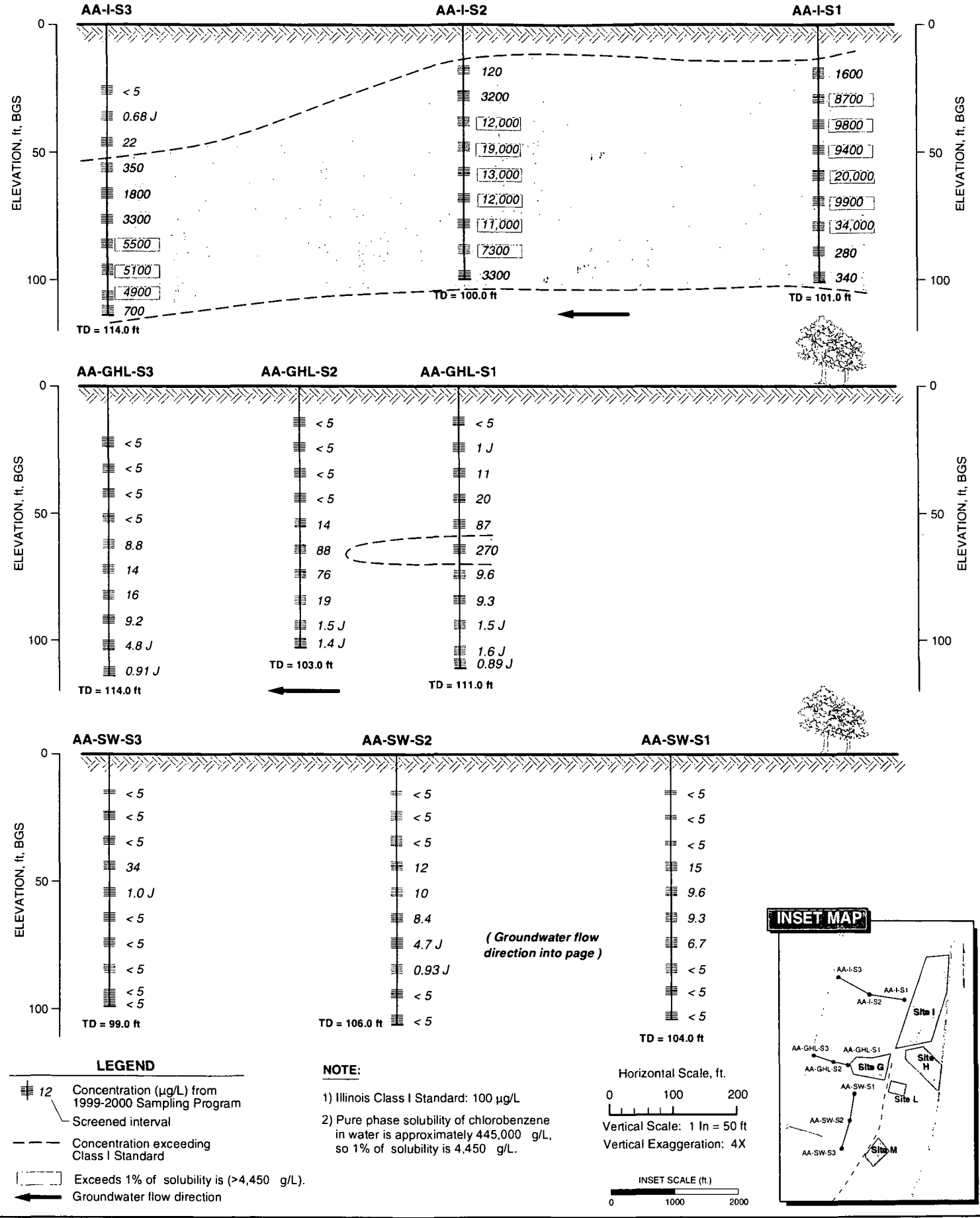
GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	1/21/05	Chk'd By:	CJN
Revised:		Aprv'd By:	CJN
Scale:	As Shown		

FIGURE B-1

CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois



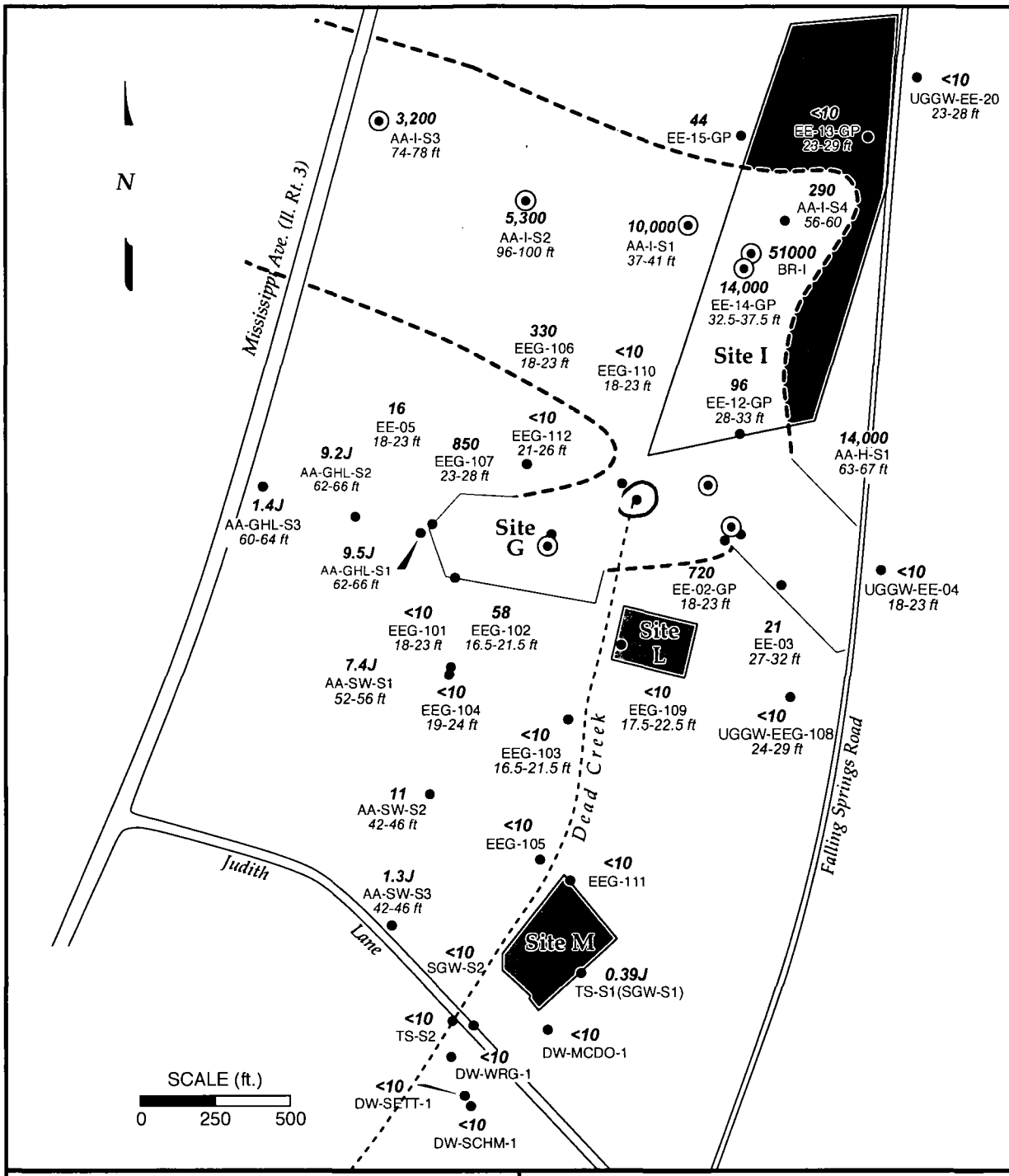
GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	1/21/05	Chk'd By:	CJN
Revised:		Aprv'd By:	
Scale:	As Shown		

FIGURE B-2

CHLOROBENZENE CONCENTRATIONS VS. DEPTH IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois



NOTES: 1) Illinois Class I Standard: 75 µg/L.

2) Pure phase solubility of 1,4 - dichlorobenzene approximately 80,000 µg/L, so 1% of solubility is 800 µg/L.

LEGEND

3.5	Maximum concentration over entire depth interval
●	Sampling locations (µg/L) from 1999-2000 Sampling Program
AA-GHL-S3	Well name
90-94 ft	Depth interval with maximum concentration (ft bgs.)
○	Exceeds 1% of solubility is (>800 µg/L).
— —	Concentration exceeding Class I Standard

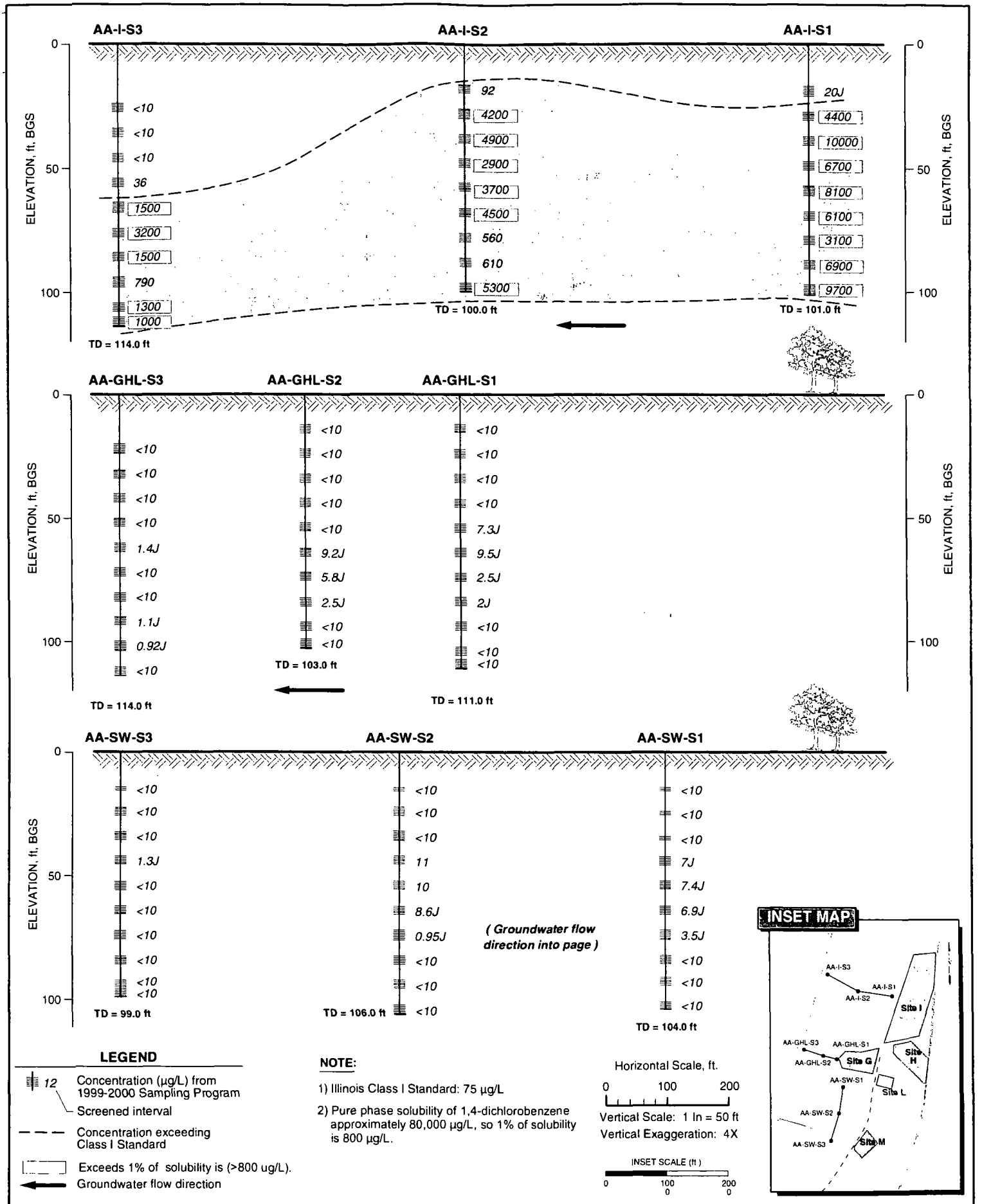
GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	1/21/05	Chk'd By:	CJN
Revised:		Aprv'd By:	CJN
Scale:	As Shown		

FIGURE B-3

1,4-DICHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois



LEGEND

- 12 — Concentration (µg/L) from 1999-2000 Sampling Program
- Screened interval
- Concentration exceeding Class I Standard
- Exceeds 1% of solubility is (>800 ug/L).
- Groundwater flow direction

NOTE:

1) Illinois Class I Standard: 75 µg/L

2) Pure phase solubility of 1,4-dichlorobenzene approximately 80,000 µg/L, so 1% of solubility is 800 µg/L.

Horizontal Scale, ft.
0 100 200
Vertical Scale: 1 In = 50 ft
Vertical Exaggeration: 4X
INSET SCALE (ft)
0 100 200
0 0

GROUNDWATER SERVICES, INC.

GSI Job No.	G-2876	Drawn By:	TUH
Issued:	1/21/05	Chk'd By:	CJN
Revised:		Aprv'd By:	
Scale:	As Shown		

FIGURE B-4

1,4-DICHLOROBENZENE CONCENTRATIONS VS. DEPTH IN GROUNDWATER

Sauget Area 1
Sauget and Cahokia, Illinois

GROUNDWATER SERVICES, INC.

TABLE 2-1

BENZENE CONCENTRATION IN GROUNDWATER AT AA-I-S1

Sauget Area 1, Sauget, Illinois

Benzene in Groundwater		
Depth Interval (ft bgs)	**Reported Concentration (mg/L)**	**Averages for SHU, MHU, DHU (mg/L)**
17-21	0.620	SHU (0-30 ft): 0.46
27-31	0.290	
37-41	<0.120	MHU (30-70 ft): 0.081
47-51	0.190	
57-61	<0.120	
67-71	0.012	
77-81	0.140 J	DHU (70-110 ft): 0.088
87-91	0.074	
87-91 (FD)	0.077	
97-101	0.050	

Notes:

1) bgs = below ground surface. FD = field duplicate. SHU = Shallow Hydrogeologic Unit. MHU = Middle Hydrogeologic Unit. DHU = Deep Hydrogeologic Unit.

2) A value of half the detection limit (0.06 mg/L) was used for the 37-41 ft and 57-61 ft samples when calculating the average concentration for the MHU. A value of 0.075 mg/L was used for the 87-91 ft sample when calculating the average concentration for the DHU.

3) Lab results are from the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Data Report, Solutia Inc., January 2001.

GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENT 3 – TCLP TEST RESULTS FOR WASTE BORINGS IN FILL AREAS

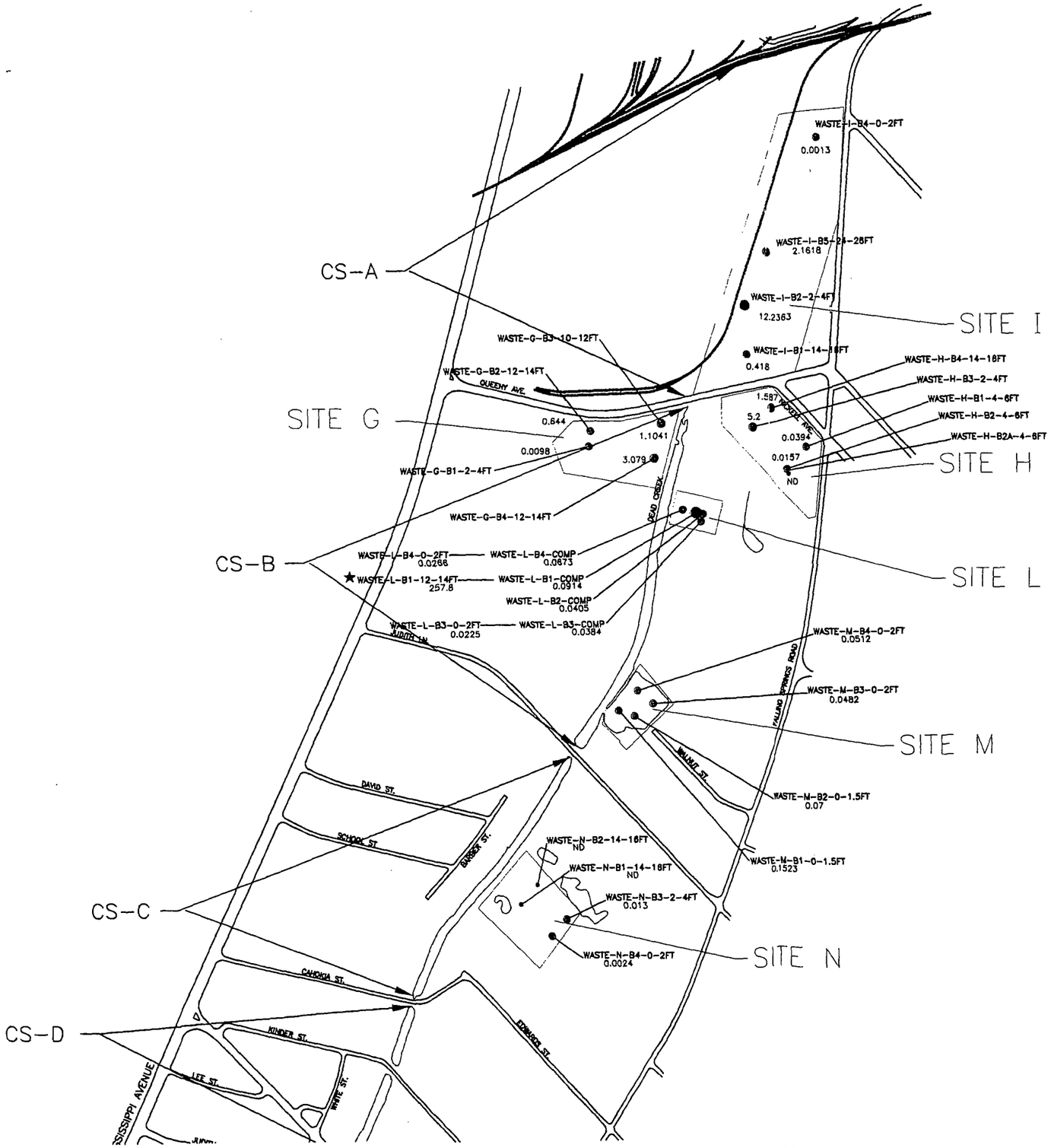
Figure 4-11: Waste Composite Borings – Total TCLP VOCs

Figure 4-12: Waste Composite Borings – Total TCLP SVOCs

Table 8-1b: Sauget Area 1 Waste – TCLP Volatile Organic Compounds

Table 8-2b: Sauget Area 1 Waste – TCLP Semivolatile Organic Compounds

Note: Figures 4-11 and 4-12 are from the Sauget Area 1 EE/CA and RI/FS report, Revision 1, Roux Associates, June 8, 2001. Tables 8-1b and 8-2b are from Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Data Report, January 2001.



LEGEND

- NOT DETECTED
- < 1
- 1 – 10
- 10 – 100
- 100 – 1000
- > 1000

CS-A CREEK SEGMENT

SITE H FILL AREA

WATER BODY

★ RESULT IS FOR TOTAL VOCs (ug/Kg)

NOTE: UNITS = mg/L

N

NOTE:
DRAWING DERIVED FROM O'BRIEN & GERE DRAWING 25501.TCLP.A
FIGURE 8-1 DATED AUGUST 2000

600 0 600
SCALE IN FEET

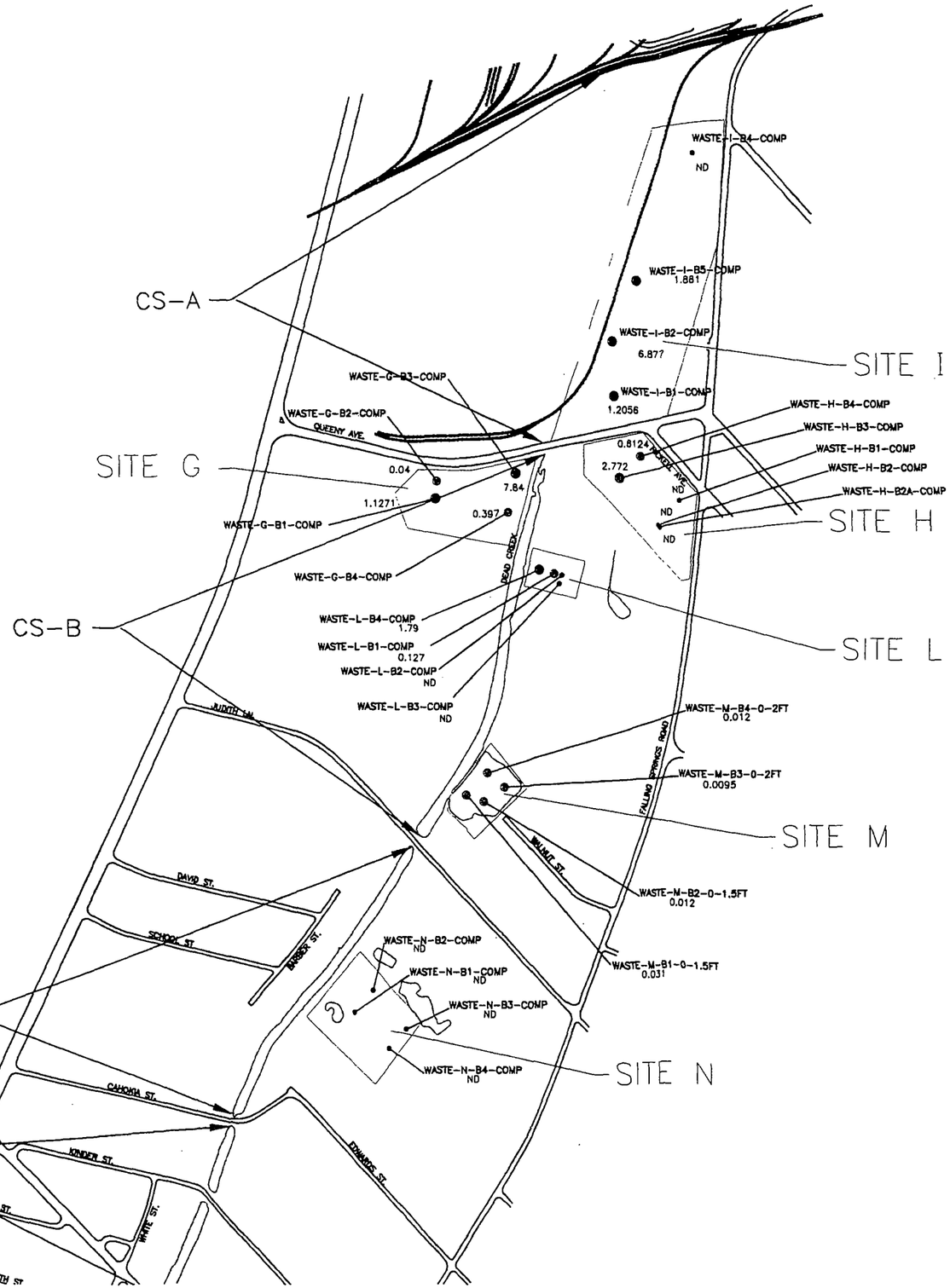
Title: **WASTE COMPOSITE BORINGS TOTAL TCLP VOCs SAUGET AREA 1**

SAUGET AND CAHOKIA, ILLINOIS

Prepared For: SOLUTIA

ROUX ASSOCIATES, INC. Environmental Consulting & Management

Compiled by: L.W.R.	Date: 02/01	FIGURE
Prepared by: M.J.S.	Scale: AS SHOWN	4-11
Project Mgr: J.R.L.	Office: TX	
File No: 46T04.4-26 4-32	Project: 06846T04	



N

LEGEND

- • NOT DETECTED
- < 1
- 1 – 10
- 10 – 100
- 100 – 1000
- > 1000
- CS–A CREEK SEGMENT
- SITE H FILL AREA
- WATER BODY

NOTE: UNITS = mg/L

NOTE:
DRAWING DERIVED FROM O'BRIEN & GERE DRAWING 25501.TCLP.B
FIGURE 8–2 DATED AUGUST 2000

600 0 600
SCALE IN FEET

Title: **WASTE COMPOSITE BORINGS TOTAL TCLP SVOCs SAUGET AREA 1**

SAUGET AND CAHOKIA, ILLINOIS

Prepared For: SOLUTIA

ROUX ASSOCIATES, INC. Environmental Consulting & Management

Compiled by: L.W.R.	Date: 02/01	FIGURE
Prepared by: M.J.S.	Scale: AS SHOWN	4-12
Project Mgr: J.R.L.	Office: TX	
File No: 46T04.4–26 4–32	Project: 06846T04	

O'BRIEN & GERE ENGINEERS, INC.

Table 8-1b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8260B Volatile Organic Compound Data

	Sample ID	WASTE-G-B1-2-4FT	WASTE-G-B2-12-14FT	WASTE-G-B3-10-12FT	WASTE-G-B3-10-12FTFD	WASTE-G-B4-12-14FT	WASTE-H-B1-4-6FT	WASTE-H-B2-4-6FT
	Sample Date	10/08/99	10/08/99	10/11/99	10/11/99	10/12/99	10/01/99	10/01/99
	Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound								
1,1-Dichloroethene		0.02 U	0.02 U	0.02 U	0.025 U	0.02 U	0.02 U	0.02 U
1,2-Dichloroethane		0.02 U	0.02 U	0.02 U	0.025 U	0.02 U	0.02 U	0.02 U
2-Butanone (MEK)		0.1 U	0.1 U	0.16	0.08 J	0.1 U	0.1 U	0.1 U
Benzene		0.02 U	0.035	0.92	0.28	0.17	0.02 U	0.02 U
Carbon tetrachloride		0.02 U	0.02 U	0.02 U	0.025 U	0.02 U	0.02 U	0.02 U
Chlorobenzene		0.02 U	0.57	0.018 J	0.012 J	2.7	0.02 U	0.02 U
Chloroform		0.02 U	0.02 U	0.02 U	0.025 U	0.02 U	0.02 U	0.02 U
Tetrachloroethene		0.0074 J	0.027	0.02 U	0.025 U	0.13	0.033	0.013 J
Trichloroethene		0.0024 J	0.012 J	0.0061 J	0.0026 J	0.079	0.0064 J	0.0027 J
Vinyl chloride		0.04 U	0.04 U	0.04 U	0.05 U	0.04 U	0.04 U	0.04 U
Total VOCs		0.0098	0.644	1.1041	0.3746	3.079	0.0394	0.0157

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

Data not validated.

Date Printed: 08/30/00 15:01:35
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FXP File: D:\25501\TABLEPRS.FXP

File Number: 10040.25501

O'BRIEN & GERE ENGINEERS, INC.

Table 8-1b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8260B Volatile Organic Compound Data

Sample ID	WASTE-H-B2A-4-6FT	WASTE-H-B3-2-4FT	WASTE-H-B4-14-16FT	WASTE-HEB	WASTE-I-B1-14-16FT	WASTE-I-B2-2-4FT	WASTE-I-B4-0-2FT
Sample Date	10/05/99	10/04/99	10/04/99	10/05/99	10/14/99	10/15/99	10/14/99
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound							
1,1-Dichloroethene	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
1,2-Dichloroethane	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
2-Butanone (MEK)	0.1 U	1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzene	0.02 U	2.3	0.087	0.02 U	0.068	0.14	0.02 U
Carbon tetrachloride	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chlorobenzene	0.02 U	2.7	1.5	0.02 U	0.35	8.9	0.02 U
Chloroform	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	2.9	0.02 U
Tetrachloroethene	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	0.29	0.02 U
Trichloroethene	0.02 U	0.2 U	0.02 U	0.02 U	0.02 U	0.0063 J	0.0013 J
Vinyl chloride	0.04 U	0.4 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Total VOCs	ND	5.2	1.587	ND	0.418	12.2363	0.0013

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-1b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8260B Volatile Organic Compound Data

Compound	Sample ID	Sample Date	Units
	WASTE-I-B5-24-26FT	10/15/99	mg/l
	WASTE-I-B5-24-26FTFD	10/15/99	mg/l
	WASTE-L-B1-COMP	09/29/99	mg/l
	WASTE-L-B2-COMP	09/29/99	mg/l
	WASTE-L-B3-0-2FT	09/30/99	mg/l
	WASTE-L-B3-COMP	09/30/99	mg/l
	WASTE-L-B4-0-2FT	09/30/99	mg/l
1,1-Dichloroethene	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
1,2-Dichloroethane	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
2-Butanone (MEK)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzene	0.76	0.26	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Carbon tetrachloride	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chlorobenzene	1.4	1	0.0074 J	0.02 U	0.02 U	0.02 U	0.02 U
Chloroform	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Tetrachloroethene	0.02 U	0.02 U	0.072	0.034	0.019 J	0.032	0.022
Trichloroethene	0.0018 J	0.0011 J	0.012 J	0.0065 J	0.0035 J	0.0064 J	0.0046 J
Vinyl chloride	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Total VOCs	2.1618	1.2611	0.0914	0.0405	0.0225	0.0384	0.0266

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-1b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8260B Volatile Organic Compound Data

	Sample ID	WASTE-L-B4-COMP	WASTE-M-B1-0-1.5FT	WASTE-M-B2-0-1.5FT	WASTE-M-B3-0-2FT	WASTE-M-B4-0-2FT	WASTE-M-B4-0-2FTFD	WASTE-N-B1-14-16FT
	Sample Date	09/30/99	10/14/99	10/14/99	10/14/99	10/14/99	10/14/99	11/30/99
	Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound								
1,1-Dichloroethene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U
1,2-Dichloroethane		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U
2-Butanone (MEK)		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.10 U
Benzene		0.02 U	0.0011 J	0.02 U	0.0012 J	0.0012 J	0.0012 J	0.020 U
Carbon tetrachloride		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U
Chlorobenzene		0.032	0.15	0.049	0.047	0.05	0.034	0.020 U
Chloroform		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U
Tetrachloroethene		0.03	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.020 U
Trichloroethene		0.0053 J	0.0012 J	0.021	0.02 U	0.02 U	0.0082 J	0.020 U
Vinyl chloride		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.040 U
Total VOCs		0.0673	0.1523	0.07	0.0482	0.0512	0.0434	ND

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-1b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8260B Volatile Organic Compound Data

	Sample ID	WASTE-N-B2-14-16FT	WASTE-N-B3-2-4FT	WASTE-N-B3-2-4FTFD	WASTE-N-B4-0-2FT
	Sample Date	12/01/99	12/01/99	12/01/99	12/02/99
	Units	mg/l	mg/l	mg/l	mg/l
Compound					
1,1-Dichloroethene		0.020 U	0.020 U	0.020 U	0.020 U
1,2-Dichloroethane		0.020 U	0.020 U	0.020 U	0.020 U
2-Butanone (MEK)		0.10 U	0.10 U	0.10 U	0.10 U
Benzene		0.020 U	0.013 J	0.020 U	0.020 U
Carbon tetrachloride		0.020 U	0.020 U	0.020 U	0.020 U
Chlorobenzene		0.020 U	0.020 U	0.020 U	0.020 U
Chloroform		0.020 U	0.020 U	0.020 U	0.020 U
Tetrachloroethene		0.020 U	0.020 U	0.020 U	0.020 U
Trichloroethene		0.020 U	0.020 U	0.020 U	0.0024 J
Vinyl chloride		0.040 U	0.040 U	0.040 U	0.040 U
Total VOCs		ND	0.013	ND	0.0024

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-2b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8270C Semivolatile Organic Compound Data

	Sample ID	WASTE-G-B1-COMP	WASTE-G-B2-COMP	WASTE-G-B3-COMP	WASTE-G-B3-COMPFD	WASTE-G-B4-COMP	WASTE-H-B1-COMP	WASTE-H-B2-COMP
	Sample Date	10/08/99	10/08/99	10/11/99	10/11/99	10/12/99	10/01/99	10/01/99
	Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound								
1,4-Dichlorobenzene		0.05 U	0.04 J	0.32	0.11	0.16 J	0.05 U	0.05 U
2,4,5-Trichlorophenol		0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.05 U
2,4,6-Trichlorophenol		0.0091 J	0.05 U	7.1	2.8	0.2 U	0.05 U	0.05 U
2,4-Dinitrotoluene		0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.05 U
2-Methylphenol (o-cresol)		0.05 U	0.05 U	0.05 U	0.099	0.014 J	0.05 U	0.05 U
Cresol m & p (TCLP)		0.05 U	0.05 U	0.15	0.12	0.084 J	0.05 U	0.05 U
Cresol o,m,p (TCLP)		0.05 U	0.05 U	0.15	0.22	0.097 J	0.05 U	0.05 U
Hexachlorobenzene		0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.05 U
Hexachlorobutadiene		0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.05 U
Hexachloroethane		0.05 U	0.05 U	0.05 U	0.05 U	0.2 U	0.05 U	0.05 U
Nitrobenzene		0.018 J	0.05 U	0.12	0.027 J	0.042 J	0.05 U	0.05 U
Pentachlorophenol		1.1	0.25 U	0.25 U	0.25 U	1 U	0.25 U	0.25 U
Pyridine (TCLP)		0.25 U	0.25 U	0.25 U	0.25 U	1 U	0.25 U	0.25 U
Total Semivolatiles		1.1271	0.04	7.84	3.376	0.397	ND	ND

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-2b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8270C Semivolatile Organic Compound Data

	Sample ID	WASTE-H-B2A-COMP	WASTE-H-B3-COMP	WASTE-H-B4-COMP	WASTE-HEB	WASTE-I-B1-COMP	WASTE-I-B2-COMP	WASTE-I-B4-COMP
	Sample Date	10/05/99	10/04/99	10/04/99	10/05/99	10/14/99	10/15/99	10/14/99
	Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound								
1,4-Dichlorobenzene		0.05 U	1.6	0.1	0.05 U	0.0056 J	1.3	0.05 U
2,4,5-Trichlorophenol		0.05 U	0.05 U	0.02 J	0.05 U	0.05 U	1.4	0.05 U
2,4,6-Trichlorophenol		0.05 U	0.051	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4-Dinitrotoluene		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.038 J	0.05 U
2-Methylphenol (o-cresol)		0.05 U	0.055	0.0063 J	0.05 U	0.05 U	0.014 J	0.05 U
Cresol m & p (TCLP)		0.05 U	0.48	0.0061 J	0.05 U	0.05 U	0.14	0.05 U
Cresol o,m,p (TCLP)		0.05 U	0.54	0.012 J	0.05 U	0.05 U	0.16	0.05 U
Hexachlorobenzene		0.05 U	0.05 U	0.018 J	0.05 U	0.05 U	0.05 U	0.05 U
Hexachlorobutadiene		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Hexachloroethane		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrobenzene		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.013 J	0.05 U
Pentachlorophenol		0.25 U	0.046 J	0.45	0.25 U	1.2	3.8	0.25 U
Pyridine (TCLP)		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.012 J	0.25 U
Total Semivolatiles		ND	2.772	0.6124	ND	1.2056	6.877	ND

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-2b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8270C Semivolatile Organic Compound Data

Sample ID	WASTE-I-B5-COMP	WASTE-I-B5-COMPFD	WASTE-L-B1-COMP	WASTE-L-B2-COMP	WASTE-L-B3-COMP	WASTE-L-B4-COMP	WASTE-M-B1-0-1.5FT
Sample Date	10/15/99	10/15/99	09/29/99	09/29/99	09/30/99	09/30/99	10/14/99
Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound							
1,4-Dichlorobenzene	1.5	0.63	0.09	0.05 U	0.05 U	0.87	0.031 J
2,4,5-Trichlorophenol	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4,6-Trichlorophenol	0.019 J	0.0079 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2,4-Dinitrotoluene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
2-Methylphenol (o-cresol)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Cresol m & p (TCLP)	0.15	0.076	0.05 U	0.05 U	0.05 U	0.19	0.05 U
Cresol o,m,p (TCLP)	0.15	0.076	0.05 U	0.05 U	0.05 U	0.19	0.05 U
Hexachlorobenzene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Hexachlorobutadiene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Hexachloroethane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Nitrobenzene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Pentachlorophenol	0.062 J	0.024 J	0.25 U	0.25 U	0.25 U	0.15 J	0.25 U
Pyridine (TCLP)	0.25 U	0.25 U	0.037 J	0.25 U	0.25 U	0.39	0.25 U
Total Semivolatiles	1.881	0.8139	0.127	ND	ND	1.79	0.031

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-2b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8270C Semivolatile Organic Compound Data

	Sample ID	WASTE-M-B2-0-1.5FT	WASTE-M-B3-0-2FT	WASTE-M-B4-0-2FT	WASTE-M-B4-0-2FTFD	WASTE-N-B1-COMP	WASTE-N-B2-COMP	WASTE-N-B3-COMP
	Sample Date	10/14/99	10/14/99	10/14/99	10/14/99	11/10/99	12/01/99	12/01/99
	Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Compound								
1,4-Dichlorobenzene		0.012 J	0.0095 J	0.012 J	0.015 J	0.050 U	0.050 U	0.050 U
2,4,5-Trichlorophenol		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
2,4,6-Trichlorophenol		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
2,4-Dinitrotoluene		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
2-Methylphenol (o-cresol)		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Cresol m & p (TCLP)		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Cresol o,m,p (TCLP)		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Hexachlorobenzene		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Hexachlorobutadiene		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Hexachloroethane		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Nitrobenzene		0.05 U	0.05 U	0.05 U	0.05 U	0.050 U	0.050 U	0.050 U
Pentachlorophenol		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Pyridine (TCLP)		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Total Semivolatiles		0.012	0.0095	0.012	0.015	ND	ND	ND

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

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O'BRIEN & GERE ENGINEERS, INC.

Table 8-2b
Solutia
Sauget Area 1
Waste - Composite Samples
TCLP Method 8270C Semivolatile Organic Compound Data

	Sample ID	WASTE-N-B3-COMPFD	WASTE-N-B4-COMP
	Sample Date	12/01/99	12/02/99
	Units	mg/l	mg/l
Compound			
1,4-Dichlorobenzene		0.050 U	0.050 U
2,4,5-Trichlorophenol		0.050 U	0.050 U
2,4,6-Trichlorophenol		0.050 U	0.050 U
2,4-Dinitrotoluene		0.050 U	0.050 U
2-Methylphenol (o-cresol)		0.050 U	0.050 U
Cresol m & p (TCLP)		0.050 U	0.050 U
Cresol o,m,p (TCLP)		0.050 U	0.050 U
Hexachlorobenzene		0.050 U	0.050 U
Hexachlorobutadiene		0.050 U	0.050 U
Hexachloroethane		0.050 U	0.050 U
Nitrobenzene		0.050 U	0.050 U
Pentachlorophenol		0.25 U	0.25 U
Pyridine (TCLP)		0.25 U	0.25 U
Total Semivolatiles		ND	ND

NOTES: U - not detected, J - estimated value, N - tentatively identified, R - rejected, M - EMPC, D - result from diluted analysis, EB - equipment blank, FD - field duplicate.

Data not validated.

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GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

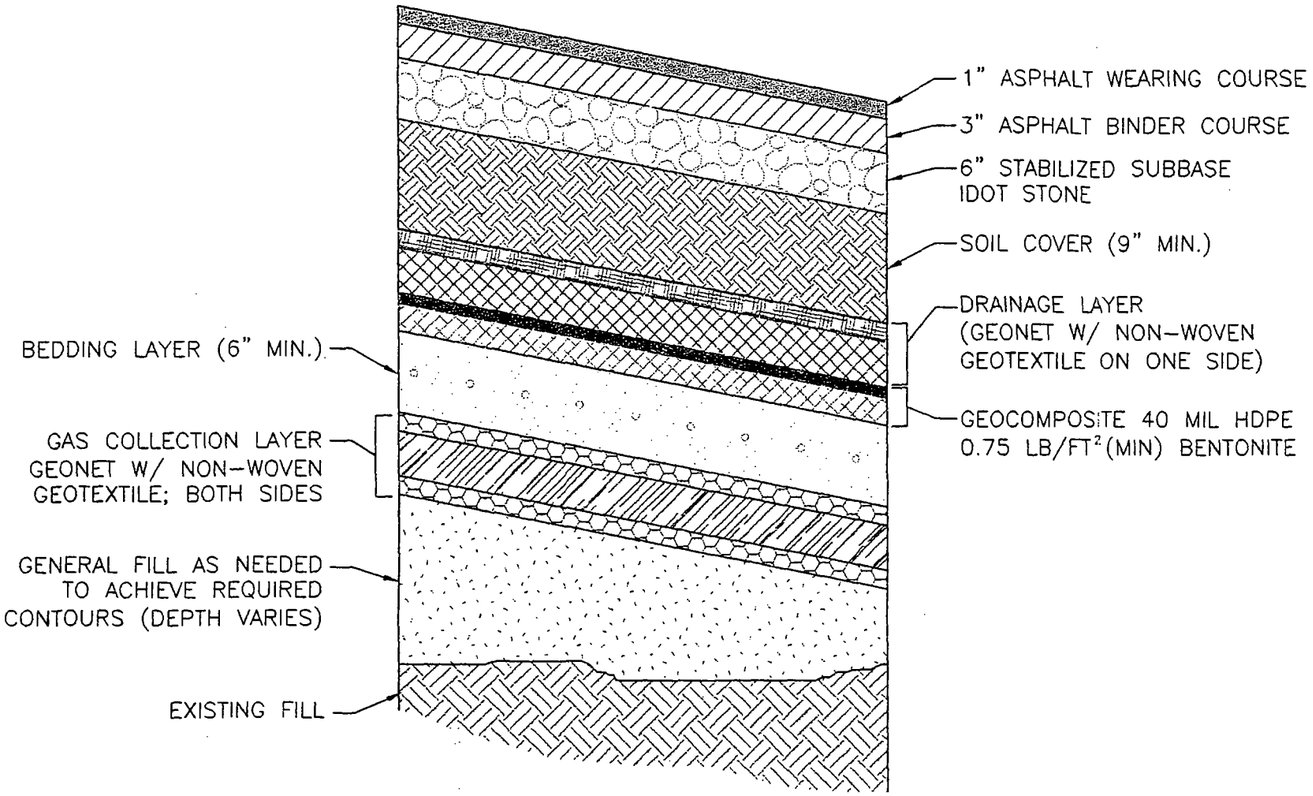
MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENT 4 – PROPOSED COVER DETAILS FOR SITE I

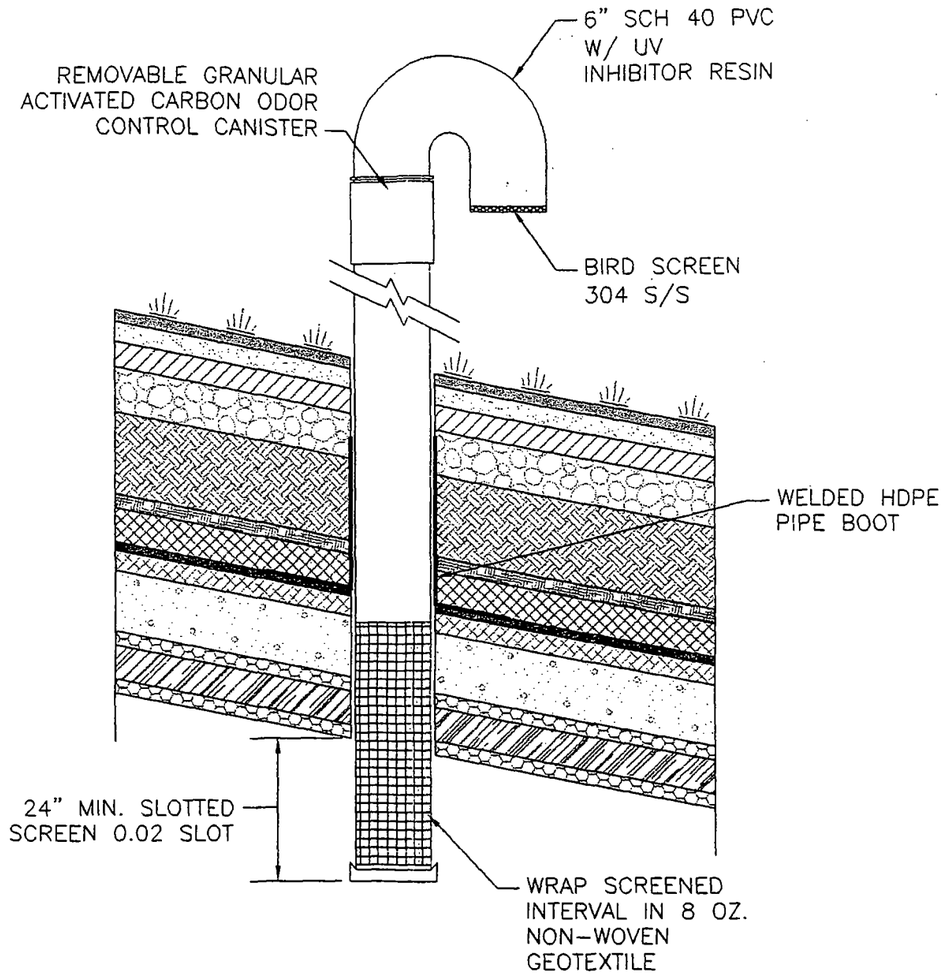
Figure 9-6: Fill Area Alternatives C, D, E, and F - Cover Details, Site I, Sauget Area 1

Note: Figures 9-6 is from the Sauget Area 1 EE/CA and RI/FS report, Revision 1, Roux Associates, June 8, 2001.



LOW PERMEABILITY COVER DETAIL (TYP.)

NOT TO SCALE



GAS VENT DETAIL (TYP.)

NOT TO SCALE

NOT FOR CONSTRUCTION

Title: **FILL AREA ALTERNATIVES C, D, E AND F COVER DETAILS, SITE I SAUGET AREA 1**

SAGUET AND CAHOKIA, ILLINOIS

Prepared For: SOLUTIA

ROUX ASSOCIATES, INC. Environmental Consulting & Management

Compiled by: A.T.	Date: 05/01	FIGURE
Prepared by: A.T.S.	Scale: AS SHOWN	9-6
Project Mgr: R.J.	Office: TX	
File No: 06646001	Project: 06646T04	

GSI Job No. G-2876
Issued: November 15, 2005

GROUNDWATER
SERVICES, INC.

MASS FLUX ESTIMATES

Sauget Area 1, Sauget and Cahokia, Illinois

ATTACHMENT 5 – HELP MODEL OUTPUT

HELP model output – Scenario 1: Existing Conditions

HELP model output – Scenario 2: After Installation of Low Permeability Cover

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**********************************************************************
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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
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PRECIPITATION DATA FILE:     C:\ADDAMS\HELPQ\I-RAIN.D4
TEMPERATURE DATA FILE:       C:\ADDAMS\HELPQ\I-TEMP.D7
SOLAR RADIATION DATA FILE:   C:\ADDAMS\HELPQ\I-SOL.D13
EVAPOTRANSPIRATION DATA:     C:\ADDAMS\HELPQ\I-EVAP.D11
SOIL AND DESIGN DATA FILE:   C:\ADDAMS\HELPQ\DATA10.D10
WATER ROUTING OUTPUT FILE:   C:\ADDAMS\HELPQ\I-NoCov2.D14
OUTPUT DATA FILE:            C:\ADDAMS\HELPQ\I-NoCov2.OUT


TIME:   9:51     DATE:   8/22/2005


**********************************************************************

     TITLE:  Site I - No Cover Leachate Study

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   1
          THICKNESS                    =      4.00   INCHES
          POROSITY                     =      0.4170 VOL/VOL
          FIELD CAPACITY               =      0.0450 VOL/VOL
          WILTING POINT                =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0659 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999978000E-02 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	164.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1640	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	16.880	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.068	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.324	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.536	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	27.154	INCHES
TOTAL INITIAL WATER	=	27.154	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ST. LOUIS MISSOURI

STATION LATITUDE	=	38.45	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	98	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.40	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	73.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	67.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.72	2.14	3.28	3.55	3.54	3.73
3.63	2.55	2.70	2.32	2.53	2.22

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.60	33.80	43.20	56.10	65.60	74.80
78.90	77.00	69.70	57.90	44.60	34.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI
AND STATION LATITUDE = 38.45 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.98	1.06	3.57	2.17	2.13	5.39
	2.13	2.72	2.99	3.19	0.66	3.66
RUNOFF	0.095	0.000	0.000	0.000	0.000	0.016
	0.000	0.000	0.116	0.045	0.000	0.007
EVAPOTRANSPIRATION	0.679	1.628	2.537	1.946	2.102	4.832
	2.330	2.930	2.018	2.217	1.003	0.772
PERCOLATION/LEAKAGE THROUGH	0.0046	0.0024	0.0043	0.0046	0.0021	0.0007
LAYER 2	0.0052	0.0036	0.0083	0.0110	0.0137	0.0063

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	30.65	1878060.000	100.00
RUNOFF	0.279	17085.736	0.91
EVAPOTRANSPIRATION	24.992	1531389.000	81.54
PERC./LEAKAGE THROUGH LAYER 2	0.066816	4094.108	0.22
CHANGE IN WATER STORAGE	5.312	325491.812	17.33
SOIL WATER AT START OF YEAR	27.154	1663824.000	
SOIL WATER AT END OF YEAR	32.466	1989315.870	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.718	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.74	1.99	4.17	5.70	6.14	7.59
	2.25	1.03	0.73	4.89	1.23	1.13
RUNOFF	0.360	1.052	2.687	0.184	0.384	0.140
	0.022	0.000	0.000	0.067	0.000	0.000
EVAPOTRANSPIRATION	0.757	0.439	1.815	3.745	3.668	5.174
	1.604	1.231	0.324	2.184	1.463	0.785
PERCOLATION/LEAKAGE THROUGH	0.0175	0.0000	0.1394	0.0950	0.3788	1.3189
LAYER 2	2.2706	1.2170	1.1618	0.8749	0.7255	1.0703

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.59	2425853.500	100.00
RUNOFF	4.897	300082.312	12.37
EVAPOTRANSPIRATION	23.189	1420887.750	58.57
PERC./LEAKAGE THROUGH LAYER 2	9.269773	567999.750	23.41
CHANGE IN WATER STORAGE	2.234	136884.031	5.64
SOIL WATER AT START OF YEAR	32.466	1989315.870	
SOIL WATER AT END OF YEAR	34.700	2126200.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.409	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.76	4.82	2.54	2.94	0.95	3.56
	6.47	2.31	3.16	1.52	3.39	1.02
RUNOFF	0.492	0.029	0.000	0.015	0.000	0.338
	0.239	0.000	0.082	0.000	0.057	0.000
EVAPOTRANSPIRATION	0.579	1.541	1.948	2.663	0.968	2.209
	4.234	2.327	1.650	1.229	1.728	0.448
PERCOLATION/LEAKAGE THROUGH	0.8860	0.3405	1.4954	1.2073	1.4295	1.1129
LAYER 2	0.4839	0.8748	1.1519	0.5047	0.9977	0.4264

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.44	2171565.000	100.00
RUNOFF	1.252	76738.070	3.53
EVAPOTRANSPIRATION	21.523	1318778.250	60.73
PERC./LEAKAGE THROUGH LAYER 2	10.911097	668570.875	30.79
CHANGE IN WATER STORAGE	1.754	107477.625	4.95
SOIL WATER AT START OF YEAR	34.700	2126200.000	
SOIL WATER AT END OF YEAR	36.194	2217785.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.259	15891.637	0.73
ANNUAL WATER BUDGET BALANCE	0.0000	0.175	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.15	1.39	3.40	4.39	3.71	4.19
	3.22	2.89	2.12	2.08	3.16	2.52
RUNOFF	0.422	0.339	0.002	0.035	0.000	0.020
	0.000	0.000	0.000	0.075	0.072	0.353
EVAPOTRANSPIRATION	0.304	1.049	1.698	3.652	3.666	2.919
	3.028	3.200	2.377	1.297	1.486	0.708
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.8475	0.5720	0.5755	0.6913	0.9840	1.0960
	0.7349	0.6505	0.6747	0.5111	0.3301	0.3140

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.22	2096809.500	100.00
RUNOFF	1.318	80761.437	3.85
EVAPOTRANSPIRATION	25.383	1555316.750	74.18
PERC./LEAKAGE THROUGH LAYER 2	7.981606	489068.125	23.32
CHANGE IN WATER STORAGE	-0.462	-28336.334	-1.35
SOIL WATER AT START OF YEAR	36.194	2217785.750	
SOIL WATER AT END OF YEAR	35.579	2180110.750	
SNOW WATER AT START OF YEAR	0.259	15891.637	0.76
SNOW WATER AT END OF YEAR	0.412	25230.512	1.20
ANNUAL WATER BUDGET BALANCE	0.0000	-0.526	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.51	0.74	2.69	4.65	4.12	5.22
	2.97	2.35	3.21	0.95	4.85	1.34
RUNOFF	0.336	0.062	0.132	0.020	0.000	0.308
	0.075	0.012	0.000	0.000	0.077	0.000
EVAPOTRANSPIRATION	0.221	0.601	2.251	3.242	3.697	3.520
	2.187	0.914	3.036	1.076	1.852	1.338
PERCOLATION/LEAKAGE THROUGH	0.4884	0.3772	0.6530	0.2777	0.4299	0.9029
LAYER 2	0.6689	1.4063	0.6030	1.0735	0.8475	0.6874

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.60	2058819.370	100.00
RUNOFF	1.021	62575.898	3.04
EVAPOTRANSPIRATION	23.935	1466618.620	71.24
PERC./LEAKAGE THROUGH LAYER 2	8.415852	515676.219	25.05
CHANGE IN WATER STORAGE	0.228	13949.068	0.68
SOIL WATER AT START OF YEAR	35.579	2180110.750	
SOIL WATER AT END OF YEAR	36.219	2219290.250	
SNOW WATER AT START OF YEAR	0.412	25230.512	1.23
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.467	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.63	2.00	3.27	3.97	3.41	5.19
	3.41	2.26	2.44	2.53	2.66	1.93
STD. DEVIATIONS	1.05	1.64	0.67	1.41	1.98	1.54
	1.77	0.73	1.05	1.56	1.70	1.14
RUNOFF						
TOTALS	0.341	0.296	0.564	0.051	0.077	0.164
	0.067	0.002	0.040	0.037	0.041	0.072
STD. DEVIATIONS	0.150	0.444	1.188	0.076	0.172	0.154
	0.101	0.006	0.056	0.036	0.038	0.157
EVAPOTRANSPIRATION						

TOTALS	0.508	1.052	2.049	3.050	2.820	3.731
	2.677	2.120	1.881	1.601	1.506	0.810
STD. DEVIATIONS	0.235	0.536	0.342	0.750	1.240	1.256
	1.007	1.014	1.010	0.554	0.326	0.325

PERCOLATION/LEAKAGE THROUGH LAYER 2

TOTALS	0.4488	0.2584	0.5735	0.4552	0.6449	0.8863
	0.8327	0.8305	0.7199	0.5951	0.5829	0.5009
STD. DEVIATIONS	0.4287	0.2508	0.5849	0.4964	0.5614	0.5165
	0.8530	0.5475	0.4754	0.4073	0.4032	0.4013

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.70 (3.252)	2126221.5	100.00
RUNOFF	1.754 (1.8052)	107448.69	5.054
EVAPOTRANSPIRATION	23.804 (1.5416)	1458598.00	68.600
PERCOLATION/LEAKAGE THROUGH LAYER 2	7.32903 (4.21143)	449081.781	21.12112
CHANGE IN WATER STORAGE	1.813 (2.2425)	111093.25	5.225

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	2.11	129288.969
RUNOFF	0.947	58032.8750
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.101115	6195.73828
SNOW WATER	1.38	84574.1406

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3034

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0503

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	0.2548	0.0637
2	35.9641	0.2193
SNOW WATER	0.000	

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G-2676
Target Area 1
With Low-K Cover

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**
** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE **
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997) **
** DEVELOPED BY ENVIRONMENTAL LABORATORY **
** USAE WATERWAYS EXPERIMENT STATION **
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY **
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PRECIPITATION DATA FILE: C:\ADDAMS\HELPQ\I-RF-C.D4
TEMPERATURE DATA FILE: C:\ADDAMS\HELPQ\I-T-C.D7
SOLAR RADIATION DATA FILE: C:\ADDAMS\HELPQ\I-SOL-C.D13
EVAPOTRANSPIRATION DATA: C:\ADDAMS\HELPQ\I-ET-C.D11
SOIL AND DESIGN DATA FILE: C:\ADDAMS\HELPQ\I-SOIL_C.D10
WATER ROUTING OUTPUT FILE: C:\ADDAMS\HELPQ\I-Wat3C.D14
OUTPUT DATA FILE: C:\ADDAMS\HELPQ\I-Wat3C.OUT

TIME: 8:21 DATE: 8/22/2005

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TITLE: Site I - Covered

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1 — Asphalt Wearing Course

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 29

THICKNESS	=	1.00	INCHES
POROSITY	=	0.4510	VOL/VOL
FIELD CAPACITY	=	0.4190	VOL/VOL
WILTING POINT	=	0.3320	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4015	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.680000028000E-06	CM/SEC

LAYER 2 Asphalt Binder Course

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 29

THICKNESS	=	3.00	INCHES
POROSITY	=	0.4510	VOL/VOL
FIELD CAPACITY	=	0.4190	VOL/VOL
WILTING POINT	=	0.3320	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4374	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.680000028000E-06	CM/SEC

LAYER 3 Stabilized Subbase IDOT Standard

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0666	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC

LAYER 4 Soil Cover

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 7

THICKNESS	=	9.00	INCHES
POROSITY	=	0.4730	VOL/VOL
FIELD CAPACITY	=	0.2220	VOL/VOL
WILTING POINT	=	0.1040	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2241	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.520000001000E-03	CM/SEC

LAYER 5 Drainage Layer

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	6.00	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 6 HDPE LINER

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	4.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 7 BENTONITE LAYER

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.50	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.6811	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 8 BEDDING LAYER

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 7

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4730	VOL/VOL
FIELD CAPACITY	=	0.2220	VOL/VOL
WILTING POINT	=	0.1040	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2220	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.520000001000E-03	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	164.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1310	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	96.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	16.880	ACRES
EVAPORATIVE ZONE DEPTH	=	0.2	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.066	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	0.090	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.066	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	27.354	INCHES
TOTAL INITIAL WATER	=	27.354	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ST. LOUIS MISSOURI

STATION LATITUDE	=	38.45	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	98	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	0.2	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.40	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	73.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	67.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.72	2.14	3.28	3.55	3.54	3.73
3.63	2.55	2.70	2.32	2.53	2.22

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.60	33.80	43.20	56.10	65.60	74.80
78.90	77.00	69.70	57.90	44.60	34.20

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ST. LOUIS MISSOURI
AND STATION LATITUDE = 38.45 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.98	1.06	3.57	2.17	2.13	5.39
	2.13	2.72	2.99	3.19	0.66	3.66
RUNOFF	0.769	0.575	2.732	1.567	1.396	4.038
	1.367	2.113	2.748	2.616	0.563	2.990
EVAPOTRANSPIRATION	0.170	0.358	0.677	0.507	0.630	1.238
	0.657	0.428	0.164	0.481	0.087	0.440
LATERAL DRAINAGE COLLECTED	0.1345	0.1143	0.0678	0.1576	0.1403	0.0938
FROM LAYER 5	0.0997	0.0927	0.1848	0.0895	0.1253	0.0393
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0030	0.0027	0.0028	0.0007	0.0008	0.0008
LAYER 9	0.0009	0.0009	0.0010	0.0029	0.0024	0.0009

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.001	0.001	0.001
TOP OF LAYER 6	0.001	0.001	0.001	0.001	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.001	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	30.65	1878060.000	100.00
RUNOFF	23.474	1438335.370	76.59
EVAPOTRANSPIRATION	5.837	357646.875	19.04
DRAINAGE COLLECTED FROM LAYER 5	1.3395	82078.445	4.37
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.134	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0008		
PERC./LEAKAGE THROUGH LAYER 9	0.019761	1210.870	0.06
CHANGE IN WATER STORAGE	-0.020	-1211.375	-0.06
SOIL WATER AT START OF YEAR	27.728	1698988.370	
SOIL WATER AT END OF YEAR	27.708	1697777.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.190	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.74	1.99	4.17	5.70	6.14	7.59
	2.25	1.03	0.73	4.89	1.23	1.13
RUNOFF	1.010	1.856	4.137	4.421	4.833	5.797
	1.889	0.897	0.580	4.007	0.914	0.489
EVAPOTRANSPIRATION	0.523	0.439	0.685	1.143	1.173	1.700
	0.329	0.105	0.086	0.760	0.202	0.351
LATERAL DRAINAGE COLLECTED	0.1255	0.1998	0.0474	0.0526	0.1034	0.1361
FROM LAYER 5	0.1431	0.0627	0.0279	0.0380	0.0886	0.1003
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0008	0.0007	0.0008	0.0007	0.0007	0.0006
LAYER 9	0.0007	0.0007	0.0006	0.0007	0.0005	0.0006

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.000	0.000	0.001	0.001
TOP OF LAYER 6	0.001	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.001	0.001

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.59	2425853.500	100.00
RUNOFF	30.830	1889094.120	77.87
EVAPOTRANSPIRATION	7.497	459365.969	18.94
DRAINAGE COLLECTED FROM LAYER 5	1.1253	68953.859	2.84
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.127	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0007		
PERC./LEAKAGE THROUGH LAYER 9	0.008082	495.206	0.02

CHANGE IN WATER STORAGE	0.130	7943.765	0.33
SOIL WATER AT START OF YEAR	27.708	1697777.000	
SOIL WATER AT END OF YEAR	27.837	1705720.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.359	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.76	4.82	2.54	2.94	0.95	3.56
	6.47	2.31	3.16	1.52	3.39	1.02
RUNOFF	2.197	3.900	1.811	2.419	0.800	2.919
	5.708	1.924	2.619	1.156	2.167	0.480
EVAPOTRANSPIRATION	0.394	0.684	0.574	0.447	0.103	0.582
	0.608	0.307	0.450	0.284	0.637	0.448
LATERAL DRAINAGE COLLECTED	0.2866	0.1063	0.2672	0.1541	0.1600	0.0584
FROM LAYER 5	0.0588	0.1084	0.1106	0.0801	0.0970	0.1191
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
LAYER 9	0.0005	0.0005	0.0004	0.0005	0.0004	0.0005

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.002	0.001	0.001	0.000
TOP OF LAYER 6	0.000	0.001	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.44	2171565.000	100.00
RUNOFF	28.099	1721776.370	79.29
EVAPOTRANSPIRATION	5.517	338051.344	15.57
DRAINAGE COLLECTED FROM LAYER 5	1.6065	98437.219	4.53
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.139	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0010		
PERC./LEAKAGE THROUGH LAYER 9	0.005778	354.030	0.02
CHANGE IN WATER STORAGE	0.211	12945.537	0.60
SOIL WATER AT START OF YEAR	27.837	1705720.750	
SOIL WATER AT END OF YEAR	27.789	1702774.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.259	15891.637	0.73
ANNUAL WATER BUDGET BALANCE	0.0000	0.418	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.15	1.39	3.40	4.39	3.71	4.19
	3.22	2.89	2.12	2.08	3.16	2.52
RUNOFF	1.106	1.186	2.778	3.227	2.646	3.638
	2.694	2.382	1.518	1.800	2.598	1.442

EVAPOTRANSPIRATION	0.303	0.183	0.418	1.052	0.913	0.448
	0.472	0.462	0.524	0.192	0.414	0.523
LATERAL DRAINAGE COLLECTED	0.2629	0.0508	0.0291	0.1443	0.1153	0.1194
FROM LAYER 5	0.1361	0.0782	0.0609	0.0649	0.0830	0.0740
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0004	0.0005	0.0003	0.0004	0.0004	0.0004
LAYER 9	0.0004	0.0003	0.0004	0.0004	0.0004	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.001	0.001	0.001
TOP OF LAYER 6	0.001	0.001	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.001
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.001

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.22	2096809.500	100.00
RUNOFF	27.016	1655358.500	78.95
EVAPOTRANSPIRATION	5.905	361841.875	17.26
DRAINAGE COLLECTED FROM LAYER 5	1.2191	74697.414	3.56
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.135	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0007		
PERC./LEAKAGE THROUGH LAYER 9	0.004524	277.224	0.01
CHANGE IN WATER STORAGE	0.076	4635.142	0.22
SOIL WATER AT START OF YEAR	27.789	1702774.620	
SOIL WATER AT END OF YEAR	27.713	1698070.870	
SNOW WATER AT START OF YEAR	0.259	15891.637	0.76

SNOW WATER AT END OF YEAR	0.412	25230.512	1.20
ANNUAL WATER BUDGET BALANCE	0.0000	-0.733	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.51	0.74	2.69	4.65	4.12	5.22
	2.97	2.35	3.21	0.95	4.85	1.34
RUNOFF	0.699	0.366	2.310	3.512	2.706	4.158
	2.235	1.999	2.445	0.728	4.275	0.681
EVAPOTRANSPIRATION	0.220	0.361	0.289	0.977	1.291	0.936
	0.692	0.249	0.719	0.168	0.490	0.532
LATERAL DRAINAGE COLLECTED	0.1979	0.0480	0.0189	0.0609	0.0997	0.1368
FROM LAYER 5	0.1467	0.0852	0.0650	0.0833	0.0606	0.0825
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0004	0.0002	0.0004	0.0005
LAYER 9	0.0001	0.0004	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.001	0.001
TOP OF LAYER 6	0.001	0.001	0.000	0.001	0.000	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	33.60	2058819.370	100.00
RUNOFF	26.114	1600149.120	77.72
EVAPOTRANSPIRATION	6.924	424285.281	20.61
DRAINAGE COLLECTED FROM LAYER 5	1.0854	66509.336	3.23
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.134	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0007		
PERC./LEAKAGE THROUGH LAYER 9	0.003723	228.127	0.01
CHANGE IN WATER STORAGE	-0.528	-32352.201	-1.57
SOIL WATER AT START OF YEAR	27.713	1698070.870	
SOIL WATER AT END OF YEAR	27.596	1690949.250	
SNOW WATER AT START OF YEAR	0.412	25230.512	1.23
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.337	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.63	2.00	3.27	3.97	3.41	5.19
	3.41	2.26	2.44	2.53	2.66	1.93
STD. DEVIATIONS	1.05	1.64	0.67	1.41	1.98	1.54
	1.77	0.73	1.05	1.56	1.70	1.14
RUNOFF						
TOTALS	1.156	1.577	2.753	3.029	2.476	4.110
	2.779	1.863	1.982	2.061	2.103	1.216
STD. DEVIATIONS	0.605	1.423	0.866	1.086	1.550	1.060
	1.708	0.568	0.920	1.300	1.479	1.067

EVAPOTRANSPIRATION

TOTALS	0.322	0.405	0.529	0.825	0.822	0.981
	0.552	0.310	0.389	0.377	0.366	0.459
STD. DEVIATIONS	0.141	0.182	0.172	0.324	0.476	0.507
	0.150	0.144	0.261	0.247	0.221	0.073

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.2015	0.1038	0.0861	0.1139	0.1237	0.1089
	0.1169	0.0854	0.0898	0.0712	0.0909	0.0830
STD. DEVIATIONS	0.0729	0.0617	0.1029	0.0525	0.0258	0.0332
	0.0375	0.0170	0.0607	0.0206	0.0235	0.0300

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 9

TOTALS	0.0010	0.0009	0.0010	0.0005	0.0005	0.0006
	0.0005	0.0006	0.0005	0.0009	0.0008	0.0005
STD. DEVIATIONS	0.0011	0.0010	0.0011	0.0002	0.0002	0.0002
	0.0003	0.0002	0.0003	0.0011	0.0009	0.0002

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0014	0.0008	0.0006	0.0008	0.0009	0.0008
	0.0008	0.0006	0.0007	0.0005	0.0007	0.0006
STD. DEVIATIONS	0.0005	0.0005	0.0007	0.0004	0.0002	0.0002
	0.0003	0.0001	0.0004	0.0001	0.0002	0.0002

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES	CU. FEET	PERCENT

PRECIPITATION	34.70	(3.252)	2126221.5	100.00
RUNOFF	27.107	(2.6945)	1660942.62	78.117
EVAPOTRANSPIRATION	6.336	(0.8365)	388238.28	18.260
LATERAL DRAINAGE COLLECTED FROM LAYER 5	1.27517	(0.20948)	78135.250	3.67484
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.134	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.001	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00837	(0.00658)	513.091	0.02413
CHANGE IN WATER STORAGE	-0.026	(0.2928)	-1607.83	-0.076

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	2.11	129288.969
RUNOFF	2.067	126640.7580
DRAINAGE COLLECTED FROM LAYER 5	0.01437	880.81104
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00048
AVERAGE HEAD ON TOP OF LAYER 6	0.003	
MAXIMUM HEAD ON TOP OF LAYER 6	0.008	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000125	7.66424
SNOW WATER	1.38	84574.1406

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4510
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.3320

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	0.4040	0.4040
2	1.3192	0.4397
3	0.3178	0.0530
4	1.9995	0.2222
5	0.0609	0.0102
6	0.0000	0.0000
7	0.3056	0.6111
8	1.3320	0.2220
9	21.4839	0.1310
SNOW WATER	0.000	

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